VOLUME 14 NUMBER 12 / JUNE 23, 1976

Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N76-21151*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPROXIMATE METHOD FOR CALCULATING TRANSONIC FLOW ABOUT LIFTING WING-BODY CONFIGURATIONS
Richard W. Barnwell Washington Apr. 1976 109 p refs
(NASA-TR-R-452; L-10482) Avail: NTIS HC $5.50 CSCL 01A

The three-dimensional problem of transonic flow about lifting wing-body configurations is reduced to a two-variable computational problem with the method of matched asymptotic expansions. The computational problem is solved with the method of relaxation. The method accounts for leading-edge separation, the presence of shock waves, and the presence of solid, slotted, or porous tunnel walls. The Mach number range of the method extends from zero to the supersonic value at which the wing leading edge becomes sonic. A modified form of the transonic area rule which accounts for the effect of lift is developed. This effect is explained from simple physical considerations. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N76-21152 Engineering Sciences Data Unit, London (England).
CRITICAL PRESSURE COEFFICIENT AND COMPONENT OF LOCAL MACH NUMBER NORMAL TO THE SURFACE ISOBAR FOR A SWEPT WING
Oct. 1975 6 p
(ESDU-75027) For information on availability of series, sub-series and other individual data items, write, NTIS, Attn: ESDU, Springfield, Va. 22161. HC $74.50

In the analysis of measured pressure distribution data on a swept wing at high speeds it is often required to establish those areas over which supercritical flow exists, to interpret the flow in terms of local Mach number (particularly the maximum value), and to identify the location and strength at the wing surface of any shock waves that might occur in the flow. These features are governed by the distribution over the wing surface to the component of local Mach number normal to the isobars. The report provides a means of estimating the component of local Mach number normal to the surface isobar and the critical pressure coefficient for a swept wing. The method is based on simple-sweep theory and would therefore be expected to apply to wings of moderate to high aspect ratio and low taper. ESDU

N76-21153 Engineering Sciences Data Unit, London (England).
DRAG DUE TO GROOVES IN A FLAT PLATE WITH TURBULENT BOUNDARY LAYER, AT SUBSONIC AND SUPERSONIC SPEEDS
Nov. 1975 13 p
(ESDU-75028) For information on availability of series, sub-series and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $122.50

Item No. 75028 is the third in the series of items concerning excrescence drag estimation. It provides a method for estimating incremental drag coefficients due to grooves in a flat plate with a turbulent boundary layer at subsonic (M less than or equal to 0.8) and supersonic (M greater than or equal to 1.4) speeds. Grooves normal, streamwise and oblique to the flow are catered for, although the data for other than normal grooves are somewhat tentative, being based on very limited experimental data for low speed flow only. In the design of an aircraft the item will be found useful in assessing the drag penalty due to gaps around, say, access hatch doors and at the skin butt joint between two wing on fuselage panels. ESDU

N76-21154*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONSERVATIVE VERSUS NONCONSERVATIVE DIFFERENCING: TRANSONIC STREAMLINE SHAPE EFFECTS Interim Report
Perry A. Newman and Jerry C. South, Jr. Feb. 1976 15 p refs
(NASA-TM-X-72827) Avail: NTIS HC $3.50 CSCL 01A

Streamline patterns calculated from transonic flow solutions which were generated using a nonconservative finite difference scheme showed a net streamtube area increase far downstream of the disturbance indicating that the global mass balance was destroyed. Similar calculations using a conservative finite difference scheme did not show this defect. Comparative calculations were made at several free-stream Mach numbers for nonlifting flow over a 10% parabolic arc airfoil. In a transonic internal flow, this nonconservation of mass may be of greater concern than in an unconfined external flow. Author.

N76-21155*# Kansas Univ., Lawrence. Flight Research Lab.
A THEORETICAL INVESTIGATION OF OVER-WING-BLOWING AERODYNAMICS
C. Edward Lan Mar. 1976 66 p refs
(Grant NsG-1139)
(NASA-CR-144969; KU-FRL-700) Avail: NTIS HC $4.50 CSCL 01A

A theoretical method is established for determining the aerodynamic characteristics of over-wing-blowing configurations. The method accounts for both jet entrainment and jet interaction effects because of the differences in freestream and jet dynamic pressures and Mach numbers. The predicted lift increments agree well with available data. It is shown that the lift is underpredicted with entrainment effect alone when the jet is close to the wing surface. Author

N76-21156*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
RAXBOD: A FORTRAN PROGRAM FOR INVISCID TRANSONIC FLOW OVER AXISYMMETRIC BODIES

James D. Keller and Jerry C. South, Jr. Feb. 1976 71 p refs
(NASA-TM-X-72831) Avail: NTIS HC $4.50 CSCL 01A

A program called RAXBOD is presented for the analysis of steady, inviscid, irrotational, transonic flow over axisymmetric bodies in free air. The method solves the exact equation for the disturbance velocity potential function and applies the exact surface boundary condition. Instructions on program usage and listings of the program and sample cases are given. Author

N76-21157# National Aerospace Lab., Tokyo (Japan).
FLOW-FIELD IN A VORTEX WITH BREAKDOWN ABOVE SHARP EDGED DELTA WINGS
Yoshio Hayashi and Teruomi Nakaya Aug. 1975 46 p refs In JAPANESE; ENGLISH summary
(NAL-TR-423) Avail: NTIS HC $4.00

The behavior is described of vortex-flow, accompanied with breakdown, formed above sharp-edged delta wings, which has been investigated experimentally and theoretically. Emphasis is placed particularly on the criterion for the breakdown at sufficiently large Reynolds numbers. Author

N76-21158*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
DYNAMICS AND IDENTIFICATION OF FLEXIBLE AIRCRAFT
William R. Wells Washington NASA Apr. 1976 68 p refs
(Grant NGR-36-004-061)
(NASA-CR-2672) Avail: NTIS HC $4.50 CSCL 01C

The equations of motion and a maximum likelihood parameter identification formulation are developed for a flexible aircraft. The various levels of approximation associated with the modal substitution representation of the elastic displacement field are discussed and illustrated when appropriate. The necessary extension of the parameter set of stability and control derivatives due to the aeroelastic effects is obtained. Author.

N76-21159*# Rockwell International Corp., Los Angeles, Calif. Aircraft Div.
SMALL SCALE NOISE AND WIND TUNNEL TESTS OF UPPER SURFACE BLOWING NOZZLE FLAP CONCEPTS. VOLUME 1. AERODYNAMIC TEST RESULTS
Dirk J. Renselaer, Roy S. Nishida, and Clayton A. Wilkin Dec. 1975 143 p refs
(Contract NAS2-8607)
(NASA-CR-137747) Avail: NTIS HC $6.00 CSCL 01A

The results and analyses of aerodynamic and acoustic studies conducted on the small scale noise and wind tunnel tests of upper surface blowing nozzle flap concepts are presented. Various types of nozzle flap concepts were tested. These are an upper surface blowing concept with a multiple slot arrangement with seven slots (seven slotted nozzle), an upper surface blowing type with a large nozzle exit at approximately mid-chord location in conjunction with a powered trailing edge flap with multiple slots (split flow or partially slotted nozzle). In addition, aerodynamic tests were continued on a similar multi-slotted nozzle flap, but with 14 slots. All three types of nozzle flap concepts tested appear to be about equal in overall aerodynamic performance but with the split flow nozzle somewhat better than the other two nozzle flaps in the landing approach mode. All nozzle flaps can be deflected to a large angle to increase drag without significant loss in lift. The nozzle flap concepts appear to be viable aerodynamic drag modulation devices for landing. Author

N76-21160*# Rockwell International Corp., Los Angeles, Calif.
SMALL SCALE NOISE AND WIND TUNNEL TESTS OF UPPER SURFACE BLOWING NOZZLE FLAP CONCEPTS. VOLUME 2. ACOUSTIC TEST RESULTS
Yoram Kadman Jan. 1976 100 p refs Prepared by Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
(Contract NAS2-8607)
(NASA-CR-137748; BBN-3130) Avail: NTIS HC $5.00 CSCL 01A

Results are summarized of acoustic tests on two advanced concepts of upper-surface-blowing propulsive lift devices. Author

N76-21161*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VORTEX MANEUVER LIFT FOR SUPER-CRUISE CONFIGURATIONS
James F. Campbell, Blair B. Gloss, and John E. Lamar Feb. 1976 26 p refs
(NASA-TM-X-72836) Avail: NTIS HC $4.00 CSCL 01A

Some of the theoretical and experimental research conducted at the NASA Langley Research Center is presented to investigate the subsonic vortex-lift producing capabilities for two classes of Super-Cruise designs: a close-coupled wing-canard arrangement and a slender wing configuration. In addition, several analytical methods are discussed for estimating critical structural design loads for thin, highly swept wings having separated leading-edge vortex flows. Author

N76-21162*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STABILITY OF ELASTIC BENDING AND TORSION OF UNIFORM CANTILEVER ROTOR BLADES IN HOVER WITH VARIABLE STRUCTURAL COUPLING
Dewey H.02Ormiston Hodges, Robert A. Washington Apr. 1976 77 p refs Prepared jointly with Army Air Mobility Res. and Dev. Lab.
(NASA-TN-D-8192; A-6375) Avail: NTIS HC $5.00 CSCL 01C

The stability of elastic flap bending, lead-lag bending, and torsion of uniform, untwisted, cantilever rotor blades without chordwise offsets between the elastic, mass, tension, and areodynamic center axes is investigated for the hovering flight condition. The equations of motion are obtained by simplifying the general, nonlinear, partial differential equations of motion of an elastic rotating cantilever blade. The equations are adapted for a linearized stability analysis in the hovering flight condition by prescribing aerodynamic forces, applying Galerkin's method, and linearizing the resulting ordinary differential equations about the equilibrium operating condition. The aerodynamic forces are obtained from strip theory based on a quasi-steady approximation of two-dimensional unsteady airfoil theory. Six coupled mode shapes, calculated from free vibration about the equilibrium operating condition, are used in the linearized stability analysis. The study emphasizes the effects of two types of structural coupling that strongly influence the stability of hingeless rotor blades. The first structural coupling is the linear coupling between flap and lead-lag bending of the rotor blade. The second structural coupling is a nonlinear coupling between flap bending, lead-lag bending, and torsion deflections. Results are obtained for a wide variety of hingeless rotor configurations and operating conditions in order to provide a reasonably complete picture of hingeless rotor blade stability characteristics. Author

N76-21163# Advisory Group for Aerospace Research and Development, Paris (France).
TECHNICAL EVALUATION REPORT OF AGARD SPECIALISTS MEETING ON WINGWITH-STORES FLUTTER
Walter J. Mykytow (AFFDL) Feb. 1976 13 p refs Meeting held at Munich, 9 oct. 1974 during 39th Meeting of Struct. and Mater. Panel
(AGARD-AR-96; ISBN-92-835-1209-X) Avail: NTIS HC $3.50

The carriage of stores on wings significantly changes their dynamic characteristics and often adversely affects their flutter properties as a result of reduced wing frequencies and the introduction of critical frequency ratios together with inertia, elastic and aerodynamic coupling between loads. Adverse flutter characteristics and significantly lowered flutter speeds occur and these restrictions severely constrain the speed -- altitude performance envelope that can be achieved by an aircraft. The variety of stores that can be carried on modern tactical airplanes generates a need to accurately evaluate the literally thousands of possible store combinations which can be carried by such aircraft. Results are presented from a conference on information and procedures in use in the various NATO nations to solve the flutter problems associated with the carriage of external stores on wings. Nine presentations were given and are summarized. Recommendations concerning possible future efforts on the subject are given. Author

N76-21164*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
FLUTTER OF ASYMMETRICALLY SWEPT WINGS

Terrence A. Weisshaar and J. B. Crittenden 12 Mar. 1976 32 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Aug. 1976
(Grant NsG-2016)
(NASA-CR-146815) Avail: NTIS HC $4.00 CSCL 01A

Two formulations of the oblique wing flutter problem are presented; one formulation allows only simple wing bending deformations and rigid body roll as degrees of freedom, while the second formulation includes a more complex bending-torsional deformation together with the roll freedom. Flutter is found to occur in two basic modes. The first mode is associated with wing bending-aircraft roll coupling and occurs at low values of reduced frequency. The second instability mode closely resembles a classical bending-torsion wing flutter event. This latter mode occurs at much higher reduced frequencies than the first. The occurrence of the bending-roll coupling mode is shown to lead to lower flutter speeds while the bending-torsion mode is associated with higher flutter speeds. The ratio of the wing mass moment of inertia in roll to the fuselage roll moment of inertia is found to be a major factor in the determination of which of the two instabilities is critical. Author

N76-21165# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.
COMPUTER PROGRAM FOR CALCULATING PRESSURE DISTRIBUTION AND COEFFICIENTS OF WINGS, BODIES, WING-BODY COMBINATIONS AND WING-TAIL COMBINATIONS IN SUBSONIC, SUPERSONIC AND HYPERSONIC FLOW
Werner Kraus 13 Nov. 1973 147 p refs In GERMAN; ENGLISH summary
(MBB-UFE-1014-0) Avail: NTIS HC $6.00

The program, developed by Boeing, was set up on an MBB IBM 370 computer for calculations based on potential theory. A comparison with measurements shows the usefulness and universal application of the method. Written in FORTRAN 4, the program may be used in design work and calculation within the subsonic, supersonic, and hypersonic speed range. ESA

N76-21166# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
DIRECT SIMULATION CALCULATIONS OF THE RAREFIED FLOW PAST A FORWARD-FACING STEP
D. I. Pullin and J. K. Harvey Sep. 1975 15 p refs
(Contract SRC-B/RG/4313)
(IC-Aero-75-09) Avail: NTIS HC $3.50

The hypersonic rarefied transition flow past a two-dimensional flat-plate forward-facing-step body combination was calculated using the direct simulation Monte Carlo method. The body surface and flow field properties obtained from the calculations led to a qualitative picture of the effect of the step on the developing flat plate merged layer flow. Along the plate near the step, however, the flow undergoes a rapid acceleration and compression accompanying sudden transition to a near Navier Stokes type state nearly in equilibrium at the body temperature.
Author (ESA)

N76-21167# Cranfield Inst. of Technology (England). Aerodynamics Div.
SUPERSONIC FLOW PAST A SLENDER DELTA WING. AN EXPERIMENTAL INVESTIGATION COVERING THE INCIDENCE RANGE MINUS 5 DEG LESS THAN OR EQUAL TO ANGLE OF INCIDENCE LESS THAN OR EQUAL TO 50 DEG
I. C. Richards Oct. 1975 36 p refs Sponsored by Min. of Defence
(Cranfield-Memo-7512) Avail: NTIS HC $4.00

A detailed survey of a delta wing of 70 deg sweep was performed at 2.5 m, in order to produce a delta wing model which could be tested over a wide range of incidence (from -5 to 50 deg). The development of the flow over the delta wing was studied and the transition region between regimes of attached and separated flow on the lee surface investigated. The measurements include upper and lower surface pressure distributions, schlieren photographs, vapor screen photographs, and surface oil flow visualization. Results were compared with thin shock-layer theory and various other predictions.
Author (ESA)

N76-21168# Bristol Univ. (England). Dept. of Aeronautical Engineering.
THE PRESSURE DISTRIBUTION OVER THE OGIVE NOSE OF A CYLINDER AT LARGE ANGLES OF INCLINATION TO A UNIFORM STREAM
D. J. Inker and M. Renshaw Jun. 1974 188 p refs
(BU-173) Avail: NTIS HC $7.50

A wind-tunnel was investigated in regard to the surface pressures on an ogive nose of a circular cylinder at angles of inclination between 40 and 70 deg to a uniform airstream for laminar flow Reynolds numbers of 6 x 10,000 and 1.2 x 100,000. Circumferential distributions of pressure coefficient, based on the cross flow dynamic pressure, at several axial stations along the nose, were calculated for each setting of inclination and Reynolds number. Corresponding axial distributions of out-of-plane and in-plane force coefficients per unit length were calculated from the pressure distributions. The results were interpreted in relation to those predicted by the impulsively-started cross flow analogy for a constant diameter cylinder and it was found that the analogy predicts, qualitatively but not quantitatively, the flow development and axial distribution of forces acting on the inclined body. It was found that the asymmetry of the flow, as seen in the pressure distributions, occurred in two distinct forms. Author (ESA)

N76-21169# Bristol Univ. (England). Dept. of Aeronautical Engineering.
AN INVESTIGATION INTO THE EFFECT OF CASTELLATING A BLUNT TRAILING EDGE IN SUPERSONIC FLOW
P. R. Hosking and D. Q. Self Jun. 1974 38 p refs
(BU-175) Avail: NTIS HC $4.00

The possibility of reducing the base drag of the blunt trailing edges on Concorde by a method of castellating the trailing edges was examined. It is concluded that castellations produce a 30 % decrease in the base drag but that the same improvement may be achieved from a uniform extension along the whole span of the wing. The investigation was carried out with a value of boundary layer momentum thickness to base height much less than that on Concorde. It is suggested that reductions in base pressures obtained in flight tests are due to effects known to occur with castellations at subsonic velocities rather than any unknown mechanism at supersonic velocities. Author (ESA)

N76-21170# Bristol Univ. (England). Dept. of Aeronautical Engineering.
AN INVESTIGATION INTO THE EFFECTS OF ASPECT RATIO AND CENTRE KEEL CAMBER ON THE AERODYNAMIC CHARACTERISTICS OF CONICAL PARAWINGS
G. P. Dave and P. L. R. Martin Jun. 1974 51 p refs
(BU-176) Avail: NTIS HC $4.50

A comparison was made of high and low aspect ratio, straight boomed parawings (aspect ratios of 2 and 4), where results similar to those from other investigations were found. The aspect ratio 2 wing produced (L/D) ratios of up to 7, and for the aspect ratio 4 wing, after a correction for leading edge boom diameter had been applied, (L/D) ratios of over 10 were obtained. Center Keel cambers were introduced onto the same two wings. The cambers were such that the spanwise and chordwise slackness ratios of the canopies were the same. Although the maximum values of (L/D) ratios were lower for the cambered wing than the uncambered versions the values of lift coefficient at which they occurred were much higher. There were also large increases in the ranges of incidence for which high (L/D) ratio values were maintained. Using information from previous reports and simple rigid wing theory, predictions were made as to the changes in characteristics with changes in aspect ratio and camber. In general the predictions were found to hold, the exceptions being due to canopy shape changes. Author (ESA)

N76-21171# Bristol Univ. (England). Dept. of Aeronautical Engineering.
TEMPERATURE DISTRIBUTIONS INSIDE HOT AIR BALLOONS
R. J. Lambert and P. Wood Jun. 1974 48 p refs
(BU-178) Avail: NTIS HC $4.00

An attempt was made to improve the efficiency of hot air balloons with respect to heat retention characteristics. The temperature distribution inside a small model of a Cameron 0-84 balloon showed the existence of a hot central core which, upon

reaching the top, deflected down the envelope. This layer, separated from the envelope, moved inwards and rejoined the central core, forming a vortex ring with cooler air at its center. This type of flow pattern with hot air adjacent to the envelope is unsatisfactory with regard to heat losses. An improvement was effected by introducing a deflector plate to break up the hot central core. This gave better mixing of the hot air inside the envelope and also left a cooler edge layer. Author (ESA)

N76-21172# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
INTERACTION OF A BUOYANT TURBULENT PLANAR JET WITH A CO-FLOWING WIND Air Force Surveys in Geophysics
Milton M. Klein and Bruce A. Kunkel 10 Jul. 1975 38 p refs
(AF Proj. 7605)
(AD-A018060; AFCRL-TR-75-0368; AFCRL-AFSG-313) Avail: NTIS CSCL 01/2

The classic theory of buoyant motion of a free planar heated jet in still air is extended to account for environmental winds from the same direction as the jet, that is, co-flowing winds. The model is applicable for wind and jet velocities up to 100 m/sec, and jet temperatures up to three times the ambient. Calculations are made for initial jet velocities of 5 and 20 m/sec and temperature excesses, relative to ambient temperature, of 0.3 and 1. For light winds relative to the initial jet velocity the vertical velocity and centerline trajectory of the plume rise rapidly with distance from the jet source. This is similar to that found with the classic theory for still air. As the wind speed approaches the initial jet velocity, the rise of the jet plume with distance from the source is much more gradual. For all wind speeds, the axial jet velocity and temperature decrease rapidly with distance from the jet source, until they become almost constant at short distances downstream. A similarity rule is derived which preserves dynamic similarity in scaling from a given system to another system. For low wind speeds the procedure is close to that based on constant Froude number.
Author (GRA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N76-21173*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
IMPACT DYNAMICS RESEARCH FACILITY FOR FULL-SCALE AIRCRAFT CRASH TESTING
Victor L. Jr. Vaughan and Emilio Alfaro-Bou Washington Apr. 1976 57 p
(NASA-TN-D-8179; L-10514) Avail: NTIS HC $4.50 CSCL 14B

An impact dynamics research facility (IDRF) was developed to crash test full-scale general aviation aircraft under free-flight test conditions. The aircraft are crashed into the impact surface as free bodies; a pendulum swing method is used to obtain desired flight paths and velocities. Flight paths up to -60 deg and aircraft velocities along the flight paths up to about 27.0 m/s can be obtained with a combination of swing-cable lengths and release heights made available by a large gantry. Seven twin engine, 2721-kg aircraft were successfully crash tested at the facility, and all systems functioned properly. Acquisition of data from signals generated by accelerometers on board the aircraft and from external and onboard camera coverage was successful in spite of the amount of damage which occurred during each crash. Test parameters at the IDRF are controllable with flight path angles accurate within 8 percent, aircraft velocity accurate within 6 percent, pitch angles accurate to 4.25 deg, and roll and yaw angles acceptable under wind velocities up to 4.5 m/s. Author

N76-21174*# Scientific Translation Service, Santa Barbara, Calif.
DIRIGIBLES; GERMANS IN THE SKY
Washington NASA Apr. 1976 8 p Transl. into ENGLISH from Der Speigel (West Ger.), no. 10, 1975 p 30-31
(Contract NASw-2791)
(NASA-TT-F-16992) Avail: NTIS HC $3.50 CSCL 01C

A discussion of a 60 meter dirigible built in Germany, which has logged 8,000 flight hours, is presented. The Bonn government is funding a 120 meter craft with a payload of 30 tons. The advantages of the commercial use of airships as opposed to aircraft are examined. The marketing of airships is also discussed. J.R.T.

N76-21175*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CHARACTERISTICS OF WAKE VORTEX GENERATED BY A BOEING 727 JET TRANSPORT DURING TWO-SEGMENT AND NORMAL ILS APPROACH FLIGHT PATHS
R. L. Kurkowski, M. R. Barber, and L. J. Garodz Washington Apr. 1976 107 p refs
(NASA-TN-D-8222; A-6208) Avail: NTIS HC $5.50 CSCL 01C

A series of flight tests was conducted to evaluate the vortex wake characteristics of a Boeing 727 (B727-200) aircraft during conventional and two-segment ILS approaches. Twelve flights of the B727, which was equipped with smoke generators for vortex marking, were flown and its vortex wake was intentionally encountered by a Lear Jet model 23 (LR-23) and a Piper Twin Comanche (PA-30). Location of the B727 vortex during landing approach was measured using a system of photo-theodolites. The tests showed that at a given separation distance there were no readily apparent differences in the upsets resulting from deliberate vortex encounters during the two types of approaches. Timed mappings of the position of the landing configuration vortices showed that they tended to descend approximately 91 m(300 ft) below the flight path of the B727. The flaps of the B727 have a dominant effect on the character of the trailed wake vortex. The clean wing produces a strong, concentrated vortex but as the flaps are lowered, the vortex system becomes more diffuse. Pilot opinion and roll acceleration data indicate that 4.5 n.mi. would be a minimum separation distance at which roll control of light aircraft (less than 5,670 kg (12,500 lb) could be maintained during parallel encounters of the B727's landing configuration wake. This minimum separation distance is generally in scale with results determined from previous tests of other aircraft using the small roll control criteria. Author

N76-21176# Federal Aviation Administration, Washington, D.C.
THE NATIONAL AVIATION SYSTEM PLAN 1976 - 1985, APPENDIX 2
Mar. 1975 109 p refs
(AD-A013614) Avail: NTIS CSCL 01/2

The Plan of 1975 is the sixth annual ten-year plan developed by the Federal Aviation Administration. It presents an integrated plan of action for meeting anticipated needs in the National Aviation System through 1985 and provides a focal point for industry/government cooperation in agency planning. Long range plans are made and policies formulated with respect to, the orderly development and use of the navigable airspace, and the orderly development and location of landing areas, Federal airways, radar installations and all other aids and facilities for air navigation, as will best meet the needs of, and serve the interest of civil aeronautics and national defense, except for those needs of military agencies which are peculiar to air warfare and primarily of military concern. The Plan summarizes system additions, improvements, and changes required to meet realistic needs of aviation for the next decade. It is oriented to serve several different groups including aviation users who pay user charges, airport sponsors who build and maintain airports, aviation manufacturers who are helping to construct the system, and FAA personnel who operate and maintain the system. GRA

N76-21177# Dayton Univ. Research Inst., Ohio.
AIRCRAFT GROUND FIRE SUPPRESSION AND RESCUE SIMULATION MODEL Final Report, Jan. 1972 - Nov. 1974
Charles D. MacArthur and Jerry B. Reeves Sep. 1975 175 p refs
(Contract F33657-72-C-0491; AF Proj. 414N)

(AD-A017679; DOD-AGFSRS-75-5) Avail: NTIS CSCL 01/2

This report presents the results of a work effort directed to the development of a mathematical model which simulates the time history of an aircraft crash fire from the time at which the crash occurs to the time of fire extinguishment. The model is comprised of a set of equations and computer programming logic which simulates fire development and suppression and which monitors conditions in and around the aircraft while a fire or fires exist. The principle results of the simulation are the survivability of personnel on board the aircraft, the damage done to the aircraft by the fire, the time required to control and extinguish the fire, and the amount of agent used in the fire suppression: The survivability of the personnel is determined by monitoring the temperature and toxic gas concentrations inside the aircraft, the availability of exits, and the presence of escape paths from the aircraft. The damage to the aircraft is determined by monitoring the skin temperature at several points on the aircraft, the pressure build-up in fuel tanks, and the presence of explosives within fires. The amount of agent and time required for fire suppression are determined by simulating the fire suppression activity. This computer model is to be used as a tool for solving a wide variety of aircraft ground fire suppression and rescue (AGFSR) problems. Author (GRA)

N76-21178# Naval Aerospace Medical Research Lab., Pensacola, Fla.

MAJOR ORIENTATION-ERROR ACCIDENTS IN REGULAR ARMY UH-1 AIRCRAFT DURING FISCAL YEAR 1971 (ACCIDENT FACTORS)

W. Carroll Hixson and Emil Spezia 7 Jul. 1975 32 p refs Prepared in cooperation with Army Aeromed. Res. Lab., Fort Rucker, Ala.

(MF51524005)

(AD-A017665; NAMRL-1219; USAARL-76-1) Avail: NTIS CSCL 01/2

This report is the fifth in a longitudinal series of reports dealing with the pilot disorientation/vertigo problem in Regular Army UH-1 helicopter operations. Individual case history data extracted from the USAAAVS master aircraft accident files are presented on major orientation-error accidents that occurred in UH-1 aircraft during fiscal year 1971. Summary data listings involving a variety of operational and pilot-related accident factors are presented for each of the 31 cases. The listings are arranged to distinguish between those factors and events present before takeoff, i.e., the initial conditions associated with a given accident, and those which occurred or were manifested during the actual airborne phase of the accident flight. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N76-21179*# Ohio Univ., Athens. Avionics Engineering Center.

NARROW BAND BINARY PHASE LOCKED LOOPS

R. W. Burhans Apr. 1976 5 p

(Grant NGR-36-009-017)

(NASA-CR-146812; TM-25) Avail: NTIS HC $3.50 CSCL 17G

Very high Q digital filtering circuits for audio frequencies in the range of 1Hz to 15 KHz are implemented in simple CMOS hardware using a binary local reference clock frequency. The circuits have application to VLF navigation receivers and other narrow band audio range tracking problems. Author

N76-21180*# Ohio Univ., Athens. Avionics Engineering Center.

IMPROVEMENTS FOR OMEGA RF PREAMPLIFIERS

Lee Wright Apr. 1976 5 p

(Grant NGR-36-009-017)

(NASA-CR-146838; TM-24) Avail: NTIS HC $3.50 CSCL 17G

An improved Omega navigation system preamplifier, which provides both ADF and Omega outputs from a single antenna input, is described. This preamp has tuneable bandpass filtering, zero phase shift at both output ports, adjustable gain at the Omega output, and it receives power via the coaxial cable to the receiver front-end. Author

N76-21181*# Ohio State Univ., Columbus. ElectroScience Lab.

RESEARCH ON MLS AIRBORNE ANTENNA Semiannual Report, period ending Nov. 1975

C. L. Yu and W. D. Burnside Apr. 1976 52 p refs Original contains color illustrations

(Grant NGL-36-008-138)

(NASA-CR-146844; SAR-2902-23) Avail: NTIS HC $4.50 CSCL 17G

Numerical solutions for the radiation patterns of antennas mounted on aircraft are developed. The airborne antenna problems associated with the Microwave Landing System (MLS) are emphasized. Based on the requirements of the MLS, volumetric pattern solutions are essential. Previous attempts at solving for the volumetric patterns were found to be far too complex and very inefficient. However as a result of previous efforts, it is possible to combine the elevation and roll plane pattern solutions to give the complete volumetric pattern. This combination is described as well as the aircraft simulation models used in the analysis. A numerical technique is presented to aid in the simulation of the aircraft studied. Finally, a description of the input data used in the computer code is given. Author

N76-21182# Michigan Univ., Ann Arbor. Radiation Lab.

IMPROVED SIDELOBE SUPPRESS ION MODE PERFORMANCE OF ATCRBS WITH VARIOUS ANTENNAS Interim Report, Jul. 1973 - Jun. 1974

Dipak L. Sengupta, Jovan Zatkalik, and Chen-To Tai Feb. 1975 166 p refs

(Contract DOT-TSC-717)

(AD-A015243; DOT-TSC-FAA-75-4; FAA-RD-75-32) Avail: NTIS HC $6.25 CSCL 17/7

The ISLS mode performance of terminal and enroute ATCRBS using existing and various improved antennas in the presence of perfectly dielectric flat ground are investigated theoretically. Necessary analytical expressions for various quantities characterizing the system performance are derived. A computer program is developed for the computation and tabulation of these quantities as functions of the elevation angle of the observation point for different combinations of heights of the directional and omnidirectional antennas. For each antenna combination results are given for the following seven quantities: the P1 and P2 pulse intensities, the pulse ratio P1/P2, the mainbeam killing and sidelobe punch-through zones in space, the effective azimuth beamwidth, the number of replies and the coverage diagram. Short discussions of results are given wherever appropriate. Author

N76-21183# Systems Technology, Inc., Hawthorne, Calif.

ILS GLIDE SLOPE STANDARDS. PART 1: A REVIEW OF FLIGHT INSPECTION STANDARDS AFFECTING LANDING PERFORMANCE AND COMPARISON WITH LIMITS EVOLVED FROM SYSTEM ANALYSIS Final Report, phase 1, 20 Aug. 1973 - 20 Aug. 1974

Lee Gregor Hofmann, Warren F. Clement, Dunstan Graham, Gary Teper, Bryon L. Wiscons (Collins Radio Co., Cedar Rapids, Iowa), David L. Hemmel (Collins Radio Co., Cedar Rapids, Iowa), and Richard H. McFarland Jun. 1975 304 p refs

(Contract DOT-FA74WA-3340)

(AD-A017087; TR-1043-Pt-1; FAA-RD-74-119-Pt-1) Avail: NTIS HC $9.75 CSCL 01/2

System analysis techniques are used to determine maximum levels for ILS glide slope beam structure characteristics which will result in acceptable approach and landing outcomes. Results are based upon a power spectral density signature for ILS glide slopes obtained from a nonstationary statistical analysis of flight inspection data for training facilities. Maximum levels and standard deviation time histories for typical aircraft/control system response, indicated glide path deviation, actual glide path

deviation, and actual glide path deviation rate are used as the basis for recommending revisions to the ILS glide slope flight inspection data processing procedures, and for recommending relaxed flight inspection standards. Author

N76-21184# Cardion Electronics, Woodbury, N.Y.
INSTRUMENT LANDING SYSTEM MONITOR PRECISION CALIBRATOR Final Report
Allan E. Greenberg Jul. 1975 105 p
(Contract DOT-FA72WA-2735)
(AD-A019962/0; FAA-RD-75-116) Avail: NTIS HC$5.50 CSCL 17/7

The ILS Monitor Precision Calibrator is a VHF-UHF signal generator, with internal modulation capability to generate localizer (VHF) and glide slope (UHF) signals. Equipment developed to provide suitably accurate ILS RF and demodulated RF for Categories II/III ILS ground equipment monitors is described. The equipment is used to verify correct response and proper alarm limit settings for ILS monitor and ILS receivers. In addition, the equipment contains a digital frequency readout indicating the output RF frequency and a digital readout that indicates DDM on dual tone and percent modulation on single tone. Author

N76-21185# National Aviation Facilities Experimental Center, Atlantic City, N.J.
THE CONTROLLER/COMPUTER INTERFACE WITH AN AIR-GROUND DATA LINK, VOLUME 1 Final Report, May - Aug. 1974
S. Rossiter, R. Wiseman (DOT), M. Connelly (MIT), and T. Morgan (Computer Services Corp.) Sep. 1975 13 p
(FAA Proj. 062-222-040)
(AD-A017086/0; FAA-NA-74-21-Vol-1; FAA-RD-75-133-Vol-1) Avail: NTIS HC $3.50 CSCL 17/7

A dynamic simulation study was conducted to determine the display techniques and operating procedures that best enable an air traffic controller to work in a mixed voice/digital communications environment. Emphasis was on the benefits that might accrue to ground-based automatic control through further automation of the controller's communication tasks. A simplified version of the ARTS III Metering and Spacing system was used to assess the controller's communication task when automatically generated control commands were transmitted to voice link or to data link-equipped aircraft in terminal approach traffic. Subject to follow-on testing of a more operational nature, it was concluded that a data link channel efficiently augments the voice channel, the value increasing as the percentage of data link aircraft increases. System test measures and questionnaire results show that further efficiencies can be obtained through the use of computer-generated speech, one-at-a-time display of commands moving with the aircraft target symbols, and by the automatic transmission of commands on both the voice and data link channels. The automatic command transmission eliminates the controller's tasks of approving commands, placing more emphasis on traffic situation monitoring. With a careful optimization of display formats and operating procedures, the controllers' acceptance of automation features will improve while they are still provided with safe traffic management and recovery techniques during system failures. Author

N76-21186# Systems Control, Inc., Palo Alto, Calif.
PRELIMINARY RNAV AVIONICS STANDARDS (2D AND 3D AREA NAVIGATION SYSTEMS) Interim Report
R. J. Adams (Champlain Technol. Ind.) Nov. 1975 374 p refs
(Contract DOT-FA72WA-3098)
(AD-A020130/1; FAA-RD-75-178) Avail: NTIS HC $10.50 CSCL 17/7

A preliminary standard for the required minimum operational characteristics applicable to 2D and 3D area navigation was developed. The method of approach utilized in achieving this objective was to perform a comprehensive analysis of existing functional and accuracy avionics standards. This analysis included the RTCA documents, the ARINC documents, FAA Advisory Circulars, FAA Handbooks, and the RNAV Task Force Report. The purpose of this analysis was to review the various levels of operational specifications and to isolate differences between the conceptual desires of the Task Force and the current equipment capabilities. Seven differences were isolated as key avionics standards issues, and are discussed. The creation of a preliminary Avionics Standards document suitable for 2D and 3D area navigation was accomplished and it includes basic design considerations, standard functional requirements and a recommendation for unresolved equipment capabilities (key avionics standards issues). Recommendations regarding the unresolved equipment capabilities are summarized, and the current data for each issue is presented and analyzed. Author

N76-21187# Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
NUMERICAL MAPPING METHODS TO REDUCE OMEGA PROPAGATION CORRECTION TABULATIONS
F. G. Stewart, L. R. Teters, and R. H. Espeland May 1975 36 p refs Prepared in cooperation with OMEGA Navigation System Operations Detail, Washington, D. C.
(PB-247481/5; ATR-75-62) Avail: NTIS HC $4.00 CSCL 17G

The report is a study of the feasibility of applying numerical mapping techniques to the storage and handling of OMEGA propagation corrections. Using the techniques discussed in the report, it is possible to represent the 110,592 propagation correction values of a representative area with 1377 coefficients. These coefficients, not necessarily an optimum set, can be used to determine the entire set of correction values for the area. The range of maximum residuals between the observed and fitted correction values was 2 to 20 cecs and the RMS residuals ranged from 1 to 5 cecs. A synthesis program and the coefficients for the test area are included in the appendix. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-21188*# Analytical Mechanics Associates, Inc., Jericho, N.Y.
STUDIES OF AIRCRAFT DIFFERENTIAL MANEUVERING. REPORT 75-27: CALCULATING OF DIFFERENTIAL-TURNING BARRIER SURFACES. REPORT 75-26: A USER'S GUIDE TO THE AIRCRAFT ENERGY-TURN AND TANDEM-MOTION COMPUTER PROGRAMS. REPORT 75-7: A USER'S GUIDE TO THE AIRCRAFT ENERGY-TURN HODOGRAPH PROGRAM Technical Report, Feb. 1975 - Jan. 1976
Henry J. Kelley and Leon Lefton Feb. 1976 58 p refs
(Contract NAS2-8738)
(NASA-CR-137819; Rept-75-27) Avail: NTIS HC $4.50 CSCL 01C

The numerical analysis of composite differential-turn trajectory pairs was studied for 'fast-evader' and 'neutral-evader' attitude dynamics idealization for attack aircraft. Transversality and generalized corner conditions are examined and the joining of trajectory segments discussed. A criterion is given for the screening of 'tandem-motion' trajectory segments. Main focus is upon the computation of barrier surfaces. Fortunately, from a computational viewpoint, the trajectory pairs defining these surfaces need not be calculated completely, the final subarc of multiple-subarc pairs not being required. Some calculations for pairs of example aircraft are presented. A computer program used to perform the calculations is included. Author

N76-21189*# Boeing Commercial Airplane Co., Seattle, Wash.
PHASE 2 PROGRAM ON GROUND TEST OF REFANNED JT8D TURBOFAN ENGINES AND NACELLES FOR THE 727 AIRPLANE. VOLUME 3: GROUND TESTS Final Report
Dec. 1975 350 p refs
(Contract NAS3-17842)
(NASA-CR-134799; D6-42440-3-Vol-3) Avail: NTIS HC $10.00 CSCL 01C

The NASA Refan Program included full-scale performance

and noise ground tests of both a current production (JT8D-15) and a refanned (JT8D-115) engine. A description of the two ground tests including detailed propulsion, noise, and structural test results is presented. The primary objectives of the total test program were comparison of JT8D-15 and JT8D-115 overall propulsion system performance and noise characteristics and determination of incremental component noise levels. Other objectives of the test program included: (1) determination of acoustic treatment effectiveness; (2) measurement of internal sound pressure levels; (3) measurement of inlet and exhaust hardware performance; (4) determination of center-engine surge margin; and (5) evaluation of certain structural characteristics associated with the 727 refan center-engine inlet duct and JT8D refan engine exhaust system. The JT8D-15 and -115 tests were conducted during September 1974 and January to March 1975, respectively. Analyses of the test data indicated that the JT8D-115, as compared to the JT8D-15, demonstrates a 12.5 percent to 13.2 percent reduction in static specific fuel consumption, and a reduction of 6 to 7 PNdB in a weighted average value of static tone corrected perceived noise level. Separated into noise components, a significant reduction was shown for the inlet fan, aft fan, exhaust duct flow, turbine, and jet noises. However, core noise was increased. Photographs of test stands and test equipment are shown. Author

N76-21190*# Boeing Commercial Airplane Co., Seattle, Wash.
PHASE 2 PROGRAM ON GROUND TEST OF REFANNED JT8D TURBOFAN ENGINES AND NACELLES FOR THE 727 AIRPLANE. VOLUME 4: AIRPLANE EVALUATION AND ANALYSIS Final Report
Dec. 1975 323 p refs
(Contract NAS3-17842)
(NASA-CR-134800; D6-42440-4-Vol-4) Avail: NTIS HC $9.75 CSCL 01C

The retrofit of JT8D-109 (refan) engines are evaluated on a 727-200 airplane in terms of airworthiness, performance, and noise. Design of certifiable hardware, manufacture, and ground testing of the essential nacelle components is included along with analysis of the certifiable airplane design to ensure airworthiness compliance and to predict the in-flight performance and noise characteristics of the modified airplane. The analyses confirm that the 727 refan airplane is certifiable. The refan airplane range would be 15% less that of the baseline airplane and block fuel would be increased by 1.5% to 3%. However, with this particular 727-200 model, with a brake release gross weight of 172,500 lb (78,245 kg), it is possible to operate the airplane (with minor structural modifications) at higher gross weights and increase the range up to 15% over the 727-200 (baseline) airplane. The refan airplane FAR Part 36 noise levels would be 6 to 8 EPNdB (effective perceived noise in decibels) below the baseline. Noise footprint studies showed that approach noise contour areas are small compared to takeoff areas. The 727 refan realizes a 68% to 83% reduction in annoyance-weighted area when compared to the 727-200 over a range of gross weights and operational procedures. Author

N76-21191# National Aviation Facilities Experimental Center, Atlantic City, N.J.
RESPONSES OF SMALL RIGID AIRCRAFT TO DISCRETE AND CONTINUOUS GUST ANALYSIS, PHASE 1 Final Report, Nov. 1972 - Nov. 1974
John Petrakis and Nelson Miller Dec. 1975 121 p refs
(AD-A020103/8; FAA-RD-74-160; FAA-NA-74-44) Avail: NTIS HC $5.50 CSCL 01/1

An evaluation is made of methods developed for estimating longitudinal and lateral rigid-body responses of airplanes to random atmospheric turbulence. A computer program, evolved from this study, calculates general aviation aircraft stability derivatives from known geometric properties used as inputs for the calculation of aircraft response (also a developed part of the computer program). It was found that the two degrees-of-freedom rigid-body power spectral density analysis produced lower normal load factor responses than a similar single degree-of-freedom analysis for aircraft of gross weight from 3,000 to 17,500 pounds. Also to produce an equivalent discrete load factor for the two degrees-of-freedom analysis, a higher spectral velocity value must be used compared to that of the single degree-of-freedom approach. Author

N76-21192# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.
DYNAMIC SIMULATION IN WINDTUNNELS, PART 1
Heinz Hoenlinger and Otto Sensburg Apr. 1975 20 p refs Presented at the AGARD Flight Mech. Panel Symp. on Flight/Ground Testing Facilities Correlation, Valloire/Modane, France, 9-12 Jun. 1975
(MBB-UFE-1180-0) Avail: NTIS HC $3.50

The techniques used to investigate flutter characteristics and flutter suppression systems are described. Two cases in which active flutter suppression was successfully applied are demonstrated. One case deals with the flutter of a wing with a store and the other with an empennage flutter case. Author (ESA)

N76-21193# AMC Inventory Research Office, Philadelphia, Pa.
DEMAND FORECASTING WITH PROGRAM FACTORS Final Report
Martin Cohen Sep. 1975 74 p refs
(AD-A017858; IRO-182) Avail: NTIS CSCL 15/5

Empirical demand forecasting studies have raised doubt about the often-made assumption that repair part demand is proportional to end-item usage. The study was made to test this assumption using a data base consisting of demands on the Army Aviation Systems Command National Inventory Point (AVSCOM NICP) for thousands of stocked items. A simulation of the NICP supply function was used to test the assumption and various proposed forecasting algorithms. The criterion was least holding and ordering cost for constant time-weighted requisitions short. The assumption that demand is proportional to end-item program was supported at least for the items responsible for the largest part of the costs, and an improved algorithm was found. GRA

N76-21194# General Dynamics/Convair, San Diego, Calif.
WEAPON SYSTEM COSTING METHODOLOGY FOR AIRCRAFT AIRFRAMES AND BASIC STRUCTURES. VOLUME 1: TECHNICAL VOLUME Final Report, Jul. 1972 - Mar. 1975
R. E. Kenyon Jun. 1975 343 p refs
(Contract F33615-72-C-2083; AF Proj. 1368)
(AD-A016408; AFFDL-TR-75-44-Vol-1) Avail: NTIS CSCL 01/3

This volume provides a detailed description of the function and use of two weapon system costing methodologies for aircraft airframes and basic structures developed for the Air Force Flight Dynamics Laboratory for use in conceptual and preliminary designs phases of weapon system development. The methods are a trade study costing method for detailed cost analysis of trade-offs between weight, cost, type of construction and type of material and a system costing method for determining the projected cost of a complete airframe within the context of a weapon system development. This volume provides a technical discussion of method development. Trade-off capability has been provided for a range of alternative structure and material combinations. A technique for independently assessing complexity factors has been developed and demonstrated. Manufacturing costs are separately estimated for the primary elements of substructure: ribs, spars, covers, leading edges, trailing edges, tips, etc. The trade study method provides an iterative capability stemming from a direct interface with design synthesis programs. A detailed cost data base and system for data expansion is provided. The methods are designed for ease in changing cost estimating relationships and estimating coefficients resulting from cost data update. Author (GRA)

N76-21195# General Dynamics/Convair, San Diego, Calif.
WEAPON SYSTEM COSTING METHODOLOGY FOR AIRCRAFT AIRFRAMES AND BASIC STRUCTURES. VOLUME 2: ESTIMATING HANDBOOK AND USER'S MANUAL, PART 2 Final Report, Jul. 1972 - Feb. 1975
R. E. Kenyon May 1975 371 p refs
(Contract F33615-72-C-2083; AF Proj. 1368)
(AD-A016410; AFFDL-TR-75-44-Vol-2-Pt-2) Avail: NTIS CSCL 01/3

For abstract, see N76-21194.

N76-21196# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALYSIS OF FAILURES IN THE PARTS OF AN AIRCRAFT

UNDERCARRIAGE
Z. S. Kulysheva and A. G. Yamov 12 Nov. 1975 11 p refs Transl. into ENGLISH from Tr. Rizhskii Inst. Inzh. Gradzhanskoi Aviatsii (USSR), no. 202 p 54-59
(AD-A017928; FTD-ID(RS)I-2308-75) Avail: NTIS CSCL 01/3

Variable loads of aircraft undercarriages are discussed. Loads from nonquality landing, the nature of the motion of the aircraft, the degree of unevenness of the airfield, and the rigidity of shock absorption are considered. Fatigue cracks and bolted joints are the most frequently caused defects. J.M.S.

N76-21197# Boeing Vertol Co., Philadelphia, Pa.
CANOPY SUN GLINT EVALUATION AND DISPLAY STANDARD Final Report, Feb. - Jun. 1975
David R. Gundling and Fred White, Jr. Oct. 1975 82 p refs (Contract DAAJ02-75-C-0016; DA Proj. 1F2-62209-AH-76)
(AD-A018079; D210-10959-1; USAAMRDL-TR-75-42) Avail: NTIS CSCL 01/3

This document describes a standard procedure for empirically determining canopy sun-glint signatures, a standard display format for the sun-glint signatures, and a procedure for analytically deriving canopy sun-glint signatures. Author (GRA)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N76-21198*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A PILOTED-SIMULATION EVALUATION OF TWO ELECTRONIC DISPLAY FORMATS FOR APPROACH AND LANDING
George G. Steimetz, Samuel A. Morello, Charles E. Knox, and Lee H. Person, Jr. Washington Apr. 1976 44 p refs
(NASA-TN-D-8183; L-10595) Avail: NTIS HC $4.00 CSCL 14B

The results of a piloted-simulation evaluation of the benefits of adding runway symbology and track information to a baseline electronic-attitude-director-indicator (EADI) format for the approach-to-landing task were presented. The evaluation was conducted for the baseline format and for the baseline format with the added symbology during 3 deg straight-in approaches with calm, cross-wind, and turbulence conditions. Flight-path performance data and pilot subjective comments were examined with regard to the pilot's tracking performance and mental workload for both display formats. The results show that the addition of a perspective runway image and relative track information to a basic situation-information EADI format improve the tracking performance both laterally and vertically during an approach-to-landing task and that the mental workload required to assess the approach situation was thus reduced as a result of integration of information. Author

N76-21199# Arinc Research Corp., Annapolis, Md.
DIGITAL AVIONICS INFORMATION SYSTEM PRELIMINARY LIFE-CYCLE-COST ANALYSIS Final Report, Nov. 1974 - May 1975
Gary K. Pruitt and Duncan L. Dieterly Sep. 1975 68 p
(Contract F09603-74-A-0844; AF Proj. 2051)
(AD-A017166; AFHRL-TR-75-34) Avail: NTIS CSCL 01/3

A mathematical model was developed and exercised to evaluate the life-cycle costs of avionics developed according to the Digital Avionics Information System (DAIS) approach. The objective was to provide an initial estimate, based on available data, of the costs and cost savings associated with the DAIS concept. A comparative analysis was performed to estimate the relative costs of the avionics of four different aircraft types for both conventional and DAIS configurations. The results of this analysis were intended only to provide a perspective of the relative costs of DAIS and conventional avionics systems; they do not necessarily represent the true costs that may be encountered in an operational environment. The depth and accuracy of the estimates made in this report are necessarily restricted by the available data and the limited scope of the study. The DAIS costs are preliminary estimates or projections supplied by the DAIS Program Office at the Air Force Avionics Laboratory (AFAL). The data for the conventional avionics were extracted from many sources, including the Increase Reliability of Operational System (IROS) data system. Therefore, interpretation of the analyses contained in this report should be restricted to an assessment of the relative cost of the avionics integration approaches that have been addressed. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N76-21200*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY EVALUATION OF A TURBINE/ROTARY COMBUSTION COMPOUND ENGINE FOR A SUBSONIC TRANSPORT
Kestutis C. Civinskas and Gerald A. Kraft Mar. 1976 59 p refs Prepared in cooperation with Army Air Mobility Res. and Develop. Lab., Cleveland
(NASA-TM-X-71906; E-8695) Avail: NTIS HC $4.50 CSCL 21E

The fuel consumption of a modern compound engine with that of an advanced high pressure ratio turbofan was compared. The compound engine was derived from a turbofan engine by replacing the combustor with a rotary combustion (RC) engine. A number of boost pressure ratios and compression ratios were examined. Cooling of the RC engine was accomplished by heat exchanging to the fan duct. Performance was estimated with an Otto-cycle for two levels of energy lost to cooling. The effects of added complexity on cost and maintainability were not examined and the comparison was solely in terms of cruise performance and weight. Assuming a 25 percent Otto-cycle cooling loss (representative of current experience), the best compound engine gave a 1.2 percent improvement in cruise. Engine weight increaseed by 23 percent. For a 10 percent Otto-cycle cooling loss (representing advanced insulation/high temperature materials technology), a compound engine with a boost PR of 10 and a compression ratio of 10 gave an 8.1 percent lower cruise than the reference turbofan. Author

N76-21201*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COLD-AIR ANNULAR-CASCADE INVESTIGATION OF AERODYNAMIC PERFORMANCE OF CORE-ENGINE-COOLED TURBINE VANES. 2: PRESSURE SURFACE TRAILING EDGE EJECTION AND SPLIT TRAILING EDGE EJECTION
Kerry L. McLallin and Louis J. Goldman Washington Apr. 1976 24 p refs
(NASA-TM-X-3369; E-8566) Avail: NTIS HC $3.50 CSCL 21E

The aerodynamic performance of two trailing edge ejection cooling configurations of a core-engine stator vane were experimentally determined in an ambient inlet-air full-annular cascade where three-dimensional effects could be obtained. The tests were conducted at the design mean-radius ideal aftermixed critical velocity ratio of 0.778. Overall vane aftermixed thermodynamic and primary efficiencies were obtained over a range of coolant flows to about 10 percent of the primary flow at a primary to coolant total temperature ratio of 1.0. The radial variation in efficiency and the circumferential and radial variations in vane-exit total pressure were determined. Comparisons are made with the solid (uncooled) vane. Author

N76-21202# Royal Aircraft Establishment, Farnborough (England).
DETERMINATION OF THE TIME-AVERAGED PRESSURES IN STRONGLY FLUCTUATING FLOWS AND ESPECIALLY IN TURBO-MACHINES
H. Weyer Jan. 1976 145 p refs Transl. into ENGLISH from the German report DLR-FR-74-34
(RAE-Lib-Trans-1850; BR51594; DLR-FR-74-34) Avail: NTIS HC $6.00

The problems of measuring pressure in strongly fluctuating flow, for example, in turbomachines, is examined with particular regard to the determination of clearly defined average pressures. A detailed description is given of the operating principles of three new procedures for determining the actual time-averages of pressure fluctuations of high frequency and amplitude and also of the construction of the corresponding measuring devices. Laboratory testing of these procedures using a newly developed calibration device that generates defined pressure fluctuations is reported along with initial tests of the measuring devices in turbocompressors. Author

N76-21203# Aeronautical Research Labs., Melbourne (Australia).
SONIC BOOM PROPAGATION AT LOW SUPERSONIC SPEEDS
N. W. Page May 1975 37 p refs
(ARL/A-143) Avail: NTIS HC $4.00

Atmospheric and flight conditions necessary to cause refraction of ray paths sufficient to reverse their vertical direction are examined. Analytical solutions were obtained for the height for vertical reversal of ray paths emanating from an aircraft flying at Mach numbers between 1 and 1.15 in a standard atmosphere with horizontal winds varying linearly with altitude. Both the height for vertical reversal of ray paths and ray path curvature were found to depend on a single non-dimensional refraction parameter which expresses the relative importance of refraction caused by vertical gradients of wind and temperature. It was shown that sonic booms of intensity sufficient to startle observers and vibrate buildings can reach the ground at distances greater than 100 km from their point of origin when sky-ward going rays are refracted down to the ground. Author

N76-21204*# New York Univ., N.Y. Aerospace and Energetics Lab.
FLUID DYNAMIC ASPECTS OF JET NOISE GENERATION Final Report, 1 Sep. 1972 - 31 Jan. 1976
Vincent Barra and Sergio Panunzio 31 Jan. 1976 136 p refs
(Grant NGR-33-016-177)
(NASA-CR-146845) Avail: NTIS HC $6.00 CSCL 20A

Jet engine noise generation and noise propagation was investigated by studying supersonic nozzle flow of various nozzle configurations in an experimental test facility. The experimental facility was constructed to provide a coaxial axisymmetric jet flow of unheated air. In the test setup, an inner primary flow exhausted from a 7 in. exit diameter convergent--divergent nozzle at Mach 2, while a secondary flow had a 10 in. outside diameter and was sonic at the exit. The large dimensions of the jets permitted probes to be placed inside the jet core without significantly disturbing the flow. Static pressure fluctuations were measured for the flows. The nozzles were designed for shock free (balanced) flow at Mach 2. Data processing techniques and experimental procedures were developed in order to study induced disturbances at the edge of the supersonic flows, and the propagation of those disturbances throughout the flows. Equipment used (specifications are given) to record acoustic levels (far field noise) is described. Results and conclusions are presented and discussed. Diagrams of the jet flow fields are included along with photographs of the test stand. J.R.T.

N76-21205*# Pratt and Whitney Aircraft, East Hartford, Conn.
MODELING AND ANALYSIS OF THE TF30-P-3 COMPRESSOR SYSTEM WITH INLET PRESSURE DISTORTION
R. S. Mazzawy and G. A. Banks Apr. 1976 133 p refs
(Contract NAS3-18535)
(NASA-CR-134996; PWA-5302) Avail: NTIS HC $6.00 CSCL 21E

Circumferential inlet distortion testing of a TF30-P-3 afterburning turbofan engine was conducted at NASA-Lewis Research Center. Pratt and Whitney Aircraft analyzed the data using its multiple segment parallel compressor model and classical compressor theory. Distortion attenuation analysis resulted in a detailed flow field calculation with good agreement between multiple segment model predictions and the test data. Sensitivity of the engine stall line to circumferential inlet distortion was calculated on the basis of parallel compressor theory to be more severe than indicated by the data. However, the calculated stall site location was in agreement with high response instrumentation measurements. Author

N76-21206*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE REDUCTION FROM THE REDESIGN OF A FAN STAGE TO MINIMIZE STATOR LIFT FLUCTUATIONS
James H. Dittmar and Richard P. Woodward 1976 10 p refs Proposed for presentation at 3d Aero-Acoustics Conf., Palo Alto, Calif., 20-23 Jul. 1976; sponsored by AIAA
(NASA-TM-X-71896; E-8682) Avail: NTIS HC $3.50 CSCL 20A

An existing fan stage, redesigned to reduce stator lift fluctuations, was acoustically tested for reduced noise generation. The lift fluctuations on the stator were reduced by increasing the stator chord, adjusting incidence angles, and by adjusting the rotor velocity diagrams. The experiments showed significantly reduced broadband noise levels in the middle to high frequencies. Blade passage tone power was not reduced, but decreases in the harmonics were observed. Aerodynamic improvements in both performance and efficiency were obtained. Author

N76-21207*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MODAL STRUCTURE INFERRED FROM STATIC FAR-FIELD NOISE DIRECTIVITY
Arthur V. Saule 1976 12 p refs Proposed for presentation at 3d Aero-Acoustics Conf., Palo Alto, Calif., 20-23 Jul. 1976; Sponsored by AIAA
(NASA-TM-X-71909; E-8704) Avail: NTIS HC $3.50 CSCL 20A

Turbofan noise directivity calculated for two directivity models was compared with experimental, blade passing frequency data from two fans at 60 and 90 percent speeds. Experimental data indicated similar directivity patterns which were well represented by a single average data curve. Calculated points using the equal amplitude model showed over-prediction near the fan axis and near the 90 degree position. Calculated points using the equal power model showed a very good match with the average data lending support to theory of equipartition of modal power from a random source such as the interaction of the rotor with inlet flow distortion. The equal modal power model also gave good agreement with individual data points. Author

N76-21208*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STIMULATION OF A TURBOFAN ENGINE FOR EVALUATION OF MULTIVARIABLE OPTIMAL CONTROL CONCEPTS
Kurt Seldner 1976 12 p refs Prepared for Presentation at Joint Autom. Control Conf., Lafayette, Ind., 27-30 Jul. 1976; sponsored by the Am. Autom. Control Council
(NASA-TM-X-71912; E-8703) Avail: NTIS HC $3.50 CSCL 21E

The development of control systems for jet engines requires a real-time computer simulation. The simulation provides an effective tool for evaluating control concepts and problem areas prior to actual engine testing. The development and use of a real-time simulation of the Pratt and Whitney F100-PW100 turbofan engine is described. The simulation was used in a multi-variable optimal controls research program using linear quadratic regulator theory. The simulation is used to generate linear engine models at selected operating points and evaluate the control algorithm. To reduce the complexity of the design, it is desirable to reduce the order of the linear model. A technique to reduce the order of the model; is discussed. Selected results between high and low order models are compared. The LQR control algorithms can be programmed on digital computer. This computer will control the engine simulation over the desired flight envelope. Author

N76-21209*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HYPERSONIC RESEARCH ENGINE/AEROTHERMODYNAMIC INTEGRATION MODEL, EXPERIMENTAL RESULTS. VOLUME 4: MACH 5 COMPONENT INTEGRATION AND PERFORMANCE
Earl H. Andrews, Jr. and Ernest A. Mackley Apr. 1976 526 p refs Prepared in cooperation with AiResearch Mfg. Co.) 3 Vol. (Contract NAS1-6666)
(NASA-TM-X-72824) Avail: NTIS HC $13.00 CSCL 21E

Tabulated computer program results of wind tunnel tests for Mach 5 components are presented. Author

N76-21210*# Pratt and Whitney Aircraft, East Hartford, Conn.
COUPLING OF HELMHOLTZ RESONATORS TO IMPROVE ACOUSTIC LINERS FOR TURBOFAN ENGINES AT LOW FREQUENCY
L. W. Dean Aug. 1975 66 p refs
(Contract NAS3-18552)
(NASA-CR-134912; PWA-5311) Avail: NTIS HC $4.50 CSCL 21E

An analytical and test program was conducted to evaluate means for increasing the effectiveness of low frequency sound absorbing liners for aircraft turbine engines. Three schemes for coupling low frequency absorber elements were considered. These schemes were analytically modeled and their impedance was predicted over a frequency range of 50 to 1,000 Hz. An optimum and two off-optimum designs of the most promising, a parallel coupled scheme, were fabricated and tested in a flow duct facility. Impedance measurements were in good agreement with predicted values and validated the procedure used to transform modeled parameters to hardware designs. Measurements of attenuation for panels of coupled resonators were consistent with predictions based on measured impedance. All coupled resonator panels tested showed an increase in peak attenuation of about 50% and an increase in attenuation bandwidth of one one-third octave band over that measured for an uncoupled panel. These attenuation characteristics equate to about 35% greater reduction in source perceived noise level (PNL), relative to the uncoupled panel, or a reduction in treatment length of about 24% for constant PNL reduction. The increased effectiveness of the coupled resonator concept for attenuation of low frequency broad spectrum noise is demonstrated. Author

N76-21211# McDonnell-Douglas Corp., Long Beach, Calif.
AIRCRAFT NOISE DEFINITION. PHASE 2: ANALYSIS OF FLYOVER-NOISE DATA FOR DC-8-61 AIRCRAFT Final Report, Nov. 1973 - Aug. 1974
R. E. DeLapp Aug. 1974 177 p refs
(Contract DOT-FA73WA-3161)
(AD-A019759/0; MDC-J4443; FAA-EQ-74-5) Avail: NTIS HC $6.75 CSCL 20/1

Phase II of the Aircraft Noise Definition program consisted of a DC-8-61 flight test program with an objective to improve the statistical accuracy of the noise data reported in Phase I of the program and to broaden the data base to inlcude measurements at long distances and at a thrust required for a steep approach. Noise measurements were made during flyovers up to an altitude of 8,000 feet, at sideline distances up to 8,000 feet and at target thrusts of 15,000, 10,000, 5,000, 3,200, and 2000 pounds. This document reports the data acquisitions, the analysis procedure, and the results in terms of variations in reference-day EPNL and A-weighted sound level with slant range; overhead to sideline noise level relationship; and data showing laterial noise attenuations. Data accuracy is described in terms of assignable confidence limits. A comparison was made between reference-day noise levels determined for surface weather conditions and by a method that accounts for upper-air variations in the sound-path weather. A method that adjusts for lateral noise attenuation in computing EPNL's for sideline locations was suggested. Photographs and descriptions of airborne computers and ground equipment employed (mobile sound recording equipment) are included. Author

N76-21212*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXHAUST EMISSIONS FROM A PREMIXING, PREVAPORIZING FLAME TUBE USING LIQUID JET A FUEL
Cecil J. Marek and Leonidas C. Papathakos Washington Apr. 1976 15 p refs
(NASA-TM-X-3383; E-8589) Avail: NTIS HC $3.50 CSCL 21E

Emissions of nitrogen oxides, carbon monoxide, and unburned hydrocarbons were measured in a burner where liquid Jet A fuel was sprayed into the heated air stream and vaporized upstream of a perforated plate flameholder. The burner was tested at inlet air temperatures at 640, 800, and 833 K, an inlet pressure of 5.6 X 100,000 N/m squared, a reference velocity of 25 m/sec, and equivalence ratios from lean blowout to 0.7. Nitrogen oxide levels of below 1.0 g NO2/kg fuel were obtained at combustion efficiencies greater than 99 percent. The measured emission levels for the liquid fuel agreed well with previously reported premixed gaseous propane data and agreed with well stirred reactor predictions. Autoignition of the premixed fuel air mixture was a problem at inlet temperatures above 650 K with 104 msec premixing time. Author

N76-21213*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ALTITUDE PERFORMANCE OF A LOW-NOISE-TECHNOLOGY FAN IN A TURBOFAN ENGINE WITH AND WITHOUT A SOUND SUPPRESSING NACELLE
Thomas J. Biesiadny, Rudolph E. Grey, and Mahmood Abdelwahah Washington Apr. 1976 31 p refs
(NASA-TM-X-3385; E-8592) Avail: NTIS HC $4.00 CSCL 21E

Test variables were inlet Reynolds number index (0.2 to 0.5), flight Mach number (0.2 to 0.8), and flow distortion (tip radial and combined circumferential - tip radial patterns). Results are limited to fan bypass and overall engine performance. There were no discernible effects of Reynolds number on fan performance. Increasing flight Mach number shifted the fan operating line such that pressure ratio decreased and airflow increased. Inlet flow distortion lowered stall margin. For a Reynolds number index of 0.2 and flight Mach number of 0.54, the sound suppressing nacelle lowered fan efficiency three points and increased specific fuel consumption about 10 percent. Author

N76-21214# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
COMMUNITY NOISE EXPOSURE RESULTING FROM AIRCRAFT OPERATIONS: ACQUISITION AND ANALYSIS OF AIRCRAFT NOISE AND PERFORMANCE DATA Final Report
Dwight E. Bishop and William J. Galloway Aug. 1975 142 p
(Contract F33615-73-C-4160; AF Proj. 7231)
(AD-A017741; BBN-2583; AMRL-TR-73-107) Avail: NTIS CSCL 20/11

This report is one of a series describing the research program undertaken by the Aerospace Medical Research Laboratory to develop procedures for predicting community noise exposure resulting from aircraft operations. This report outlines the acoustic measurement test conditions, the acoustic data reduction and interpretation procedures, and the type of aircraft performance information needed to obtain a noise data file for predicting the noise produced by aircraft operations. The procedures result in the descriptions of the noise of an aircraft in terms of the effective perceived noise level, the sound exposure level and several other noise measures. Level flight measurements and static engine noise tests are described, and are applicable to conventional fixed wing aircraft and helicopters. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N76-21215*# Analytic Sciences Corp., Reading, Mass.
THE DESIGN OF DIGITAL-ADAPTIVE CONTROLLERS FOR VTOL AIRCRAFT Final Report, 3 Mar. - 15 Nov. 1975
Robert F. Stengel, John R. Broussard, and Paul W. Berry 12 Mar. 1976 285 p refs

(Contract NAS1-13807)
(NASA-CR-144912; TR-640-1) Avail: NTIS HC $9.25 CSCL 01C

Design procedures for VTOL automatic control systems have been developed and are presented. Using linear-optimal estimation and control techniques as a starting point, digital-adaptive control laws have been designed for the VALT Research Aircraft, a tandem-rotor helicopter which is equipped for fully automatic flight in terminal area operations. These control laws are designed to interface with velocity-command and attitude-commnad guidance logic, which could be used in short-haul VTOL operations. Developments reported here include new algorithms for designing non-zero-set-point digital regulators, design procedures for rate-limited systems, and algorithms for dynamic control trim setting. Author

N76-21216*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SIMULATION STUDY OF CURVED, DESCENDING, DECELERATING, LANDING APPROACHES FOR TRANSPORT AIRCRAFT
James E. Dieudonne, Randall D. Grove, and George G. Steinmetz Washington Apr. 1976 43 p refs
(NASA-TN-D-8190; L-10584) Avail: NTIS HC $4.00 CSCL 01C

A system which is capable of controlling an aircraft automatically along a curved, descending, decelerating approach was described. A simulation study was conducted to determine the necessary modifications to the basic flight-proven control system. This basic system is presently being used to accomplish straight-in automatic landing approaches on a short-haul transport aircraft (B-737 terminal configured vehicle). This study shows that both 3 deg (normal) and 5 deg (steep) approaches could be accomplished with only minor modifications to the basic control system. Author

N76-21217*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A METHOD FOR GENERATING NUMERICAL PILOT OPINION RATINGS USING THE OPTIMAL PILOT MODEL
Ronald A. Hess Feb. 1976 58 p refs
(NASA-TM-X-73101; A-6427) Avail: NTIS HC $4.50 CSCL 05H

A method for generating numerical pilot opinion ratings using the optimal pilot model is introduced. The method is contained in a rating hypothesis which states that the numerical rating which a human pilot assigns to a specific vehicle and task can be directly related to the numerical value of the index of performance resulting from the optimal pilot modeling procedure as applied to that vehicle and task. The hypothesis is tested using the data from four piloted simulations. The results indicate that the hypothesis is reasonable, but that the predictive capability of the method is a strong function of the accuracy of the pilot model itself. This accuracy is, in turn, dependent upon the parameters which define the optimal modeling problem. A procedure for specifying the parameters for the optimal pilot model in the absence of experimental data is suggested. Author

N76-21218*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
EVALUATION OF AN ENVELOPE-LIMITING DEVICE USING SIMULATION AND FLIGHT TEST OF A REMOTELY PILOTED RESEARCH VEHICLE
Kevin L. Petersen Washington Apr. 1976 19 p refs
(NASA-TN-D-8216; H-914) Avail: NTIS HC $3.50 CSCL 01C

The operating characteristics of a nonlinear envelope-limiting device were investigated at extreme flight conditions by using a real time digital aircraft spin simulation and flight tests of a scale model remotely piloted research vehicle. A digital mechanization of the F-15 control system, including the stall inhibiter, was used in the simulation and in the control system of the scale model. The operational characteristics of the stall inhibiter and the effects of the stall inhibiter on the spin susceptibility of the airplane were investigated. Author

N76-21219# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.
A QUADRUREDUNDANT DIGITAL FLIGHT CONTROL SYSTEM FOR CCV APPLICATION
Wolfgang J. Kubbat 16 Oct. 1974 11 p Sponsored by Ger. Min. of Defence
(MBB-UFE-1116-0) Avail: NTIS HC $3.50

A parallel redundant digital fly-by-wire system is described. It will be tested in the near future on a CCV-test aircraft (modified F-104 G). Fail-op requirements and the reasons for the choice of a digital system are outlined. The system works with freely programmable identical airborne computers which run identical software. The computers perform the control laws and also act as central voters and monitors. Basic to the design is the principle of majority decision with elimination of a failed component. The quadruplex system represents a functional integration of autopilot, stabilization, air data computation, and built-in-test-equipment. Author (ESA)

N76-21220# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.
CONTROL OF AN ELASTIC AIRCRAFT USING OPTIMAL CONTROL LAWS
Werner Dressler 15 Oct. 1974 13 p Presented at the AGARD Joint Symp. on Impact of Active Control Technol. on Airplane Design, Paris, 14-17 Oct. 1974 Sponsored by Ger. Min. of Defence
(MBB-UFE-1120-0) Avail: NTIS HC $3.50

The design of a multivariable control system for gust alleviation is demonstrated. The use of computers for control design, summarized under the name computer aided design, is described. The gust control system for gust alleviation is integrated into an overall flight guidance control system. Two control designs, using optimal control laws, are achieved, one with complete and the second with incomplete state measurement. In the model description the elastic behavior of the wing is included, as well as the non-steady aerodynamic lift generation and the dynamic behavior of the actuators. The efficiency of gust alleviation is shown in a flight through turbulent air for a STOL-transport aircraft. The increase of wing lifetime and the corresponding decrease in structure weight by use of a gust alleviation system is calculated. Author (ESA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N76-21221*# Kanner (Leo) Associates, Redwood City, Calif.
STUDIES RELATIVE TO AN INDUCTION PRESSURIZED TRANSONIC WIND TUNNEL. C: FINAL DESIGN OF THE DERAT T2 WIND TUNNEL
C. Quemard Washington NASA Mar. 1975 37 p refs Transl. into ENGLISH from Onera Centre d'Etudes et de Rech. de Toulouse, Tech. Note 7/5006-DN, (France), Sep. 1974, 30 p
(Contract NASw-2481)
(NASA-TT-F-16183; TN-7/5006-DN) Avail: NTIS HC $4.00 CSCL 14B

The general operation and plan of a transonic wind tunnel are described. The design is based on results of a preliminary study that were made on a smaller, quartersized wind tunnel. An original feature is the use of an air pump incorporating injector vanes. The principal results concerning induction pressurized systems are reviewed. Details are supplied on the dimensions, installation and operational principles of the wind tunnel. Author

N76-21222*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
THE NEW TRANSONIC AND SUPERSONIC WIND TUNNEL OF THE AERODYNAMIC INSTITUTE
G. Freytag Washington NASA Apr. 1976 18 p refs Transl. into ENGLISH from Rheinisch-Westfalische Tech. Hochschule, Abhandlungen (Aachen), no. 22, 1975 p 233-238

(Contract NASw-2789)
(NASA-TT-F-16977) Avail: NTIS HC $3.50 CSCL 14B

The available compressor installations restrict the use of the new wind tunnel to an intermittent operation schedule. Operational details are discussed, taking into account the employment of suction and pressure. The design of the wind tunnel is considered, giving attention to the Laval nozzle, the free jet chamber, the diffusor, and the transonic chamber. Author

N76-21223# Federal Aviation Administration, Washington, D.C.
RUNWAY AND TAXIWAY EDGE LIGHTING SYSTEM
3 Sep. 1975 27 p refs
(AC-150/5340-24) Avail: NTIS HC $4.00

Edge lights are used to outline usable operational areas of airports during periods of darkness and low visibility weather conditions. This circular covers standards for the design and installation of runway and taxiway lights. Author

N76-21224*# Pennsylvania State Univ., University Park. Applied Research Lab.
THE 1.5 INCH ULTRA-HIGH-SPEED CAVITATION TUNNEL AT THE APPLIED RESEARCH LABORATORY OF THE PENNSYLVANIA STATE UNIVERSITY
D. S. Weir, M. L. Billet, and J. W. Holl 10 Jul. 1975 33 p refs
(Grant NGL-39-009-001; Contract N00017-73-C-1418)
(NASA-CR-135014; TM-75-188) Avail: NTIS HC $4.00 CSCL 14B

A discussion is presented on the 1.5 inch ultra-high-speed cavitation tunnel located at The Garfield Thomas Water Tunnel building of the Applied Research Laboratory at The Pennsylvania State University. Included is a description of the facility, operating procedures, and details of the tunnel calibration. The facility is designed to permit large variations in velocity, pressure, and temperature for various liquids. The maximum operating condition for these parameters is 300 fps, 1,200 psia, and 300 F. Author

N76-21225# Transportation Systems Center, Cambridge, Mass.
THE APPLICATION OF SIMULATION METHODS TO INTRA-AIRPORT LANDSIDE PROBLEMS Interim Report, 1 Jul. - 30 Dec. 1974
L. J. McCabe and T. F. Carberry Oct. 1975 101 p refs
(AD-A017084; DOT-TSC-FAA-75-12; FAA-RD-75-169) Avail: NTIS HC $5.00 CSCL 01/5

Methods are described of analyzing the flow of people through the airport landside, which is defined as extending between the airport boundary and the arrival/departure gates. Passenger delay for specified flow and holding values is taken as the desirable measure or level of service. Simulation is determined as the best method of analysis. Two types of simulation techniques are described. The deterministic accounting model evaluates mean delay or occupancies. The time oriented queueing theory model determines delay or occupancy distributions. Time oriented simulation is demonstrated as most accurately representing the stochastic interrelationships among the various landside elements. Various existing models are reviewed and two are recommended as offering potential applicability to investigate airport landside traffic. It is recommended that at least one of the chosen simulation be validated. Author

N76-21226# Science Research Council, Chilton (England).
THE 12 FOOT ARGONNE BUBBLE CHAMBER TST PROJECT. FIRST OPERATIONAL TEST, GUIDELINES
E. W. Fitzharris Jan. 1975 14 p
(RL-75-015) Avail: NTIS Avail: ERDA Depository Libraries HC $4.00

Early in 1975 it is expected that the first fully operational test of a hydrogen filled track sensitive target surrounded by a neon-hydrogen mixture will take place in the 12 foot bubble chamber at the Argonne National Laboratory. A summary is presented of previous reports based on experience gained during tests and test operation at the Argonne and Rutherford Laboratories respectively, and is intended to provide some basic guidelines for the above test. NSA

N76-21227# ARO, Inc., Arnold Air Force Station, Tenn.
AN ADAPTIVE CONTROL ALGORITHM FOR ACQUISITION OF PNEUMATIC COMMUTATOR DATA Final Report, 1 Nov. 1974 - 1 Mar. 1975
Robert G. Chapman, Thomas H. Clay, and James L. Taylor AEDC Nov. 1975 21 p Sponsored by AF
(ARO Proj. P45U)
(AD-A018022; AEDC-TR-75-140; ARO-PWT-TR-75-90) Avail: NTIS CSCL 09/1

This report describes and documents an adaptive control algorithm currently used in the Propulsion Wind Tunnel Transonic and Supersonic tunnels for the acquisition of steady-state pressure data using pneumatic commutators. The algorithm employs a classification process to determine whether or not data smoothing is required. If filtering is required, then a self-adjusting arithmetic averaging technique is used. Data obtained using the algorithms are acquired subject to both a settling criterion and a time constraint. The report contains a description of the basic instrumentation system and adaptive control algorithm.
Author (GRA)

N76-21228# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Mobility and Environmental Systems Lab.
DEVELOPMENT OF PROCEDURE FOR AIRFIELD SITE EVALUATION Final Report
Malcolm P. Keown, Judith A. Parks, and Jack K. Stoll Oct. 1975 99 p refs
(DA Proj. 4A0-62103-A-859; DA Proj. 4A1-62121-AT-31)
(AD-A017853; WES-TR-M-75-3) Avail: NTIS CSCL 15/5

This report describes the mathematical techniques used as the basis for developing a set of related computer programs that collectively represent an automated procedure for airfield site evaluation. A model that numerically delineates the topography of a selected site and a model for the layout of an airfield are analytically examined for compatibility. If the airfield and site geometries are determined to be compatible, construction time and cost estimates can be generated for vegetaion clearing, topsoil stripping, excavation at a cut location and haulage of soil from the cut to a fill lcation, spreading of fill, soil compaction, and placement of a runway surface. The runway surfaces included in the inventory of the evaluation procedure are unsurfaced with or without membrane, light-duty mat with or without membrane, medium-duty mat with or without membrane, flexible pavement, and rigid pavement. GRA

N76-21229# ARO, Inc., Arnold Air Force Station, Tenn.
EXPERIMENTS TO ASSESS THE INFLUENCE OF CHANGES IN THE TUNNEL WALL BOUNDARY LAYER ON TRANSONIC WALL CROSSFLOW CHARACTERISTICS Final Report, Nov. 1974 - Jan. 1975
R. F. Starr AEDC Nov. 1975 33 p refs
(ARO Proj. V37A-32A)
(AD-A017666; ARO-VKF-TR-75-45; AEDC-TR-75-97) Avail: NTIS CSCL 14/2

The equivalent porosity of the test section wall in a transonic wind tunnel with a fixed geometric porosity and varying wall boundary-layer displacement thickness, has been investigated. Previous experiments have demonstrated that the boundary-layer displacement thickness on the wall influences the wall cross-flow characteristic. Experimental data from a Ludwieg tube type of transonic tunnel are compared with data from conventional transonic tunnels in the Mach number range from 0.95 to 1.15. The displacement thickness studied is comparatively thin and represents typical values which will be encountered in future high Reynolds number transonic tunnels. GRA

N76-21230# Life Sciences, Inc., Hurst, Tex.
PRELIMINARY OPERATIONAL EVALUATION OF AN AUDIOVISUAL INSTRUMENT TRAINER Final Report, Sep. - Nov. 1974
Edward E. Eddowes, Phillip L. McRee, W. Guy Matheny, and Norman A. Crowder Jul. 1975 22 p refs
(Contract F41609-73-C-0039; AF Proj. 1123)
(AD-A016487; AFHRL-TR-75-49) Avail: NTIS CSCL 05/9

The audiovisual instrument trainer (AVIT) presents multi-media instruction in aircraft instrument scanning, interpretation, and flight path error correction procedures. This report describes a preliminary operational evaluation of the capability of AVIT to improve a student pilot's later instrument flying performance as measured in a T-4 simulator. An operational evaluation of AVIT was conducted by the 64th Flying Training Wing at Reese AFB,

Texas. The results of the evaluation test indicated that the AVIT-trained students made significantly more correct responses than student pilots not trained on AVIT. It was concluded that AVIT pretraining was effective as measured in this study. Consequently, it was recommended that further evaluation be accomplished to more adequately define the potential contribution of AVIT to UPT instrument training. GRA

N76-21231# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
PROJECTED INTERRUPTIONS IN AIRPORT RUNWAY OPERATIONS DUE TO FOG Air Force Surveys in Geophysics
Alan I. Weinstein 8 Apr. 1975 33 p refs
(AF Proj. 7605)
(AD-A017735; AFCRL-TR-75-0198; AFCRL-AFSIG-307) Avail: NTIS CSCL 01/5

Hourly surface weather observations are combined with air traffic records to calculate the percentage interruption in airport runway operations due to fog that can be expected at 25 Air Force bases in the United States (17) and Europe (8). It is projected that approximately 1 to 2 percent of the flights in an average year can be expected to be affected by fog at bases in the United States. In Europe, the figures rise to 2 to 4 percent. During heavily fog plagued years, the projections can be expected to double. Persistence times are approximated. Empirical equations to allow calculation of percent mission interruption and duration of the interruption are presented that allow estimates to be made for bases other than the 25 selected for this investigation. GRA

N76-21232# Air Force Weapons Lab., Kirtland AFB, N.Mex.
COMPARISON OF THE BRITISH CLASS 60 TRACKWAY AND AM-2 MAT FOR BOMB DAMAGE REPAIR APPLICATIONS Final Report
Raymond S. Rollings Nov. 1975 63 p refs
(AD-A017851; AFWL-TR-75-149) Avail: NTIS CSCL 01/5

AM-2 and British Class 60 trackway are compared as surfacing materials for bomb damage repair of runways. Each mat was evaluated on the basis of its operational characteristics, performance under load, and dynamic effects on aircraft. A field test was conducted to gather data on the performance of each mat under load, and a computer code, TAXI, was used to calculate aircraft response to the mats. AM-2 showed marginally superior load capacity and aircraft response; however the operational characteristics of the Class 60 trackway are far superior to those of AM-2. Class 60 trackway was concluded to be a superior surfacing material for bomb damage repair. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

No abstracts in this category.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N76-21233*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
STUDY OF THE DECAY AND RECOVERY OF ORBITING ARTIFICIAL SPACE OBJECTS Final Report, 1 Dec. 1965 - 30 Jun. 1971
Apr. 1976 28 p
(Grant NGR-09-015-007)
(NASA-CR-146801) Avail: NTIS HC $4.00 CSCL 22A

The reentry of earth-orbiting space objects unconsumed in the atmosphere represents a potential hazard to populated areas of the earth. The Smithsonian Astrophysical Observatory has conducted a program called Moonwatch, whose purposes were to observe orbiting artificial satellites and reentries of space objects and, if possible, to recover and analyze reentered pieces. In addition, through observations of low-perigee objects, data obtained by Moonwatchers have been instrumental in defining some of the factors affecting satellite decay. The objectives of the program are presented, and the problems that enter into satellite-orbit and decay predictions are addressed. Moonwatchers contributed substantially to increasing an overall prediction capability, and some of the specific achievements over the 6-year period are cited. Author

N76-21234# National Aerospace Lab., Tokyo (Japan).
ON THE PREDICTION OF UNIVERSAL TIME IN A SIMULATION OF SATELLITE MOTION
Koichi Matsushima Oct. 1975 31 p In JAPANESE; ENGLISH summary
(NAL-TR-430) Avail: NTIS HC $4.00

An analysis of the periodicity of the irregular rotation of the earth was made and 12 periodic terms ranging from 9 years to 180 years were found. The combinations of these terms are in good agreement with the observed data. A prediction of AT-UT1 for the next coming ten years was made, taking seasonal change of the rotation into account. Time measurement systems and precession and nutation of the earth's axis of rotation is described in detail. Author

N76-21235*# Lockheed Electronics Co., Houston, Tex.
PINES METHOD FOR CIRCULAR AND ELLIPTICAL ORBITS
Cary Semar Feb. 1976 39 p refs
(Contract NAS9-12200)
(NASA-CR-147538; LEC-7951; JSC-10924) Avail: NTIS HC $4.00 CSCL 22A

The Pines method for trajectory integration is derived from the equations of two-body motion. The concept of the perturbation derivative is explained and a formal definition is presented. An algorithm for applying the Pines method to numerical integration of trajectories is included. Author

N76-21236*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
OPTIMUM IMPULSE TRANSITIONS FROM A POINT TO AN ELLIPTICAL ORBIT
V. V. Ivashkin and A. P. Skorokhodov Washington NASA Apr. 1976 42 p refs Transl. into English from Acad. of Sci., Inst. of Appl. Math. (Moscow), Preprint no. 81, 1975 43 p
(Contract NASw-2789)
(NASA-TT-F-16829; Preprint-81) Avail: NTIS HC $4.00 CSCL 22A

The optimization of orbital transitions for a space probe (SP) (for energy losses) with an impulse thrust in the Kepler field close to a plant is presented. The initial state (the point on the initial orbit) is given by the distance to the center of gravity, by the radial and transversal projections for the SP velocity vector. However, at the end of the transition one must obtain an elliptical orbit with assigned constants of squares and energy. The distance from the SP to the center of gravity is limited below and above. The transition time is free. Classification of the orbits and transitions is given. By analyzing the necessary optimal conditions all optimum solutions were obtained for the case, where the osculating orbit, corresponding to the initial data, intersects the external boundary of the admissible ring. From one to four impulses were transmitted given optimal transitions. Author

N76-21237*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
ON THE TESSERAL-HARMONICS RESONANCE PROBLEM IN ARTIFICIAL-SATELLITE THEORY, PART 2
Barbara A. Romanowicz 10 Mar. 1976 32 p refs
(Grant NGR-09-015-002)
(NASA-CR-146854; SAO-Special-Rept-373-Pt-2) Avail: NTIS HC $4.00 CSCL 22A

Equations were derived for the perturbations on an artificial satellite when the motion of the satellite is commensurable with that of the earth. This was done by first selecting the tesseral harmonics that contribute the most to the perturbations and then by applying Hori's method by use of Lie series. Here, are

introduced some modifications to the perturbations, which now result in better agreement with numerical integration. Author

N76-21238# Lockheed Missiles and Space Co., Palo Alto, Calif.
DETECTION OF A HIGH-FREQUENCY SECONDARY-ELECTRON RESONANCE DISCHARGE UNDER IONOSPHERE CONDITIONS, ITS INVESTIGATION AND MEASUREMENT OF THE CHARGED PARTICLE CONCENTRATION ON THE SALYUT ORBITER
K. I. Gringauz, V. I. Patsaev, V. A. Rudakov, and Iu. V. Khodataev [1975] 8 p refs Transl. into ENGLISH from Kosmich. Issled. (USSR), v. 13, no. 5, 1975 p 716-722
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Experiments conducted on the Salyut orbiting laboratory in 1971 to investigate a high-frequency secondary-electron resonance discharge under ionosphere conditions are described. The fundamental characteristics of the apparatus used and some results obtained are presented. Author

N76-21239# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON BOARD SALYUT-4
V. Samoilov 13 Nov. 1975 9 p Transl. into ENGLISH from Kommunist (Moscow), no. 132, 1975 p 3
(AD-A018167) Avail: NTIS CSCL 06/3

Experiments in space biology are part of the extensive program carried out on board the orbiting scientific laboratory 'Salyut-4'. Living organisms taken on the flight are alive and developing. The cosmonauts observe them and take note of their growth characteristics under the required conditions which they maintain. Later, the biological objects will return to earth with the crew for further laboratory study. This is the general course of all biological experiments carried out in space. GRA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N76-21240* National Aeronautics and Space Administration, Washington, D.C.
PIONEER VENUS 1978
Mar. 1976 40 p
(NASA-News-Release-76-53; P76-10064) Avail: NASA Scientific and Technical Information Facility, P. O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

An orbiter and a multiprobe spacecraft will be sent to Venus in 1978 to conduct a detailed examination of the planet's atmosphere and weather. The spin-stabilized multiprobe spacecraft consists of a bus, a large probe and three identical small probes, each carrying a complement of scientific instruments. The large probe will conduct a detailed sounding of the lower atmosphere, obtaining measurements of the clouds, atmospheric structure, wind speed, and atmospheric composition. Primary emphasis will be placed on the planet's energy balance and clouds. The three small probes will provide information on the circulation pattern of the lower atmosphere. The probe bus will provide data on the upper atmosphere and ionosphere down to an altitude of about 120 km. The orbiter is designed to globally map the atmosphere, ionosphere, and the solar wind/ionosphere interaction. In addition, it will utilize radar mapping techniques to study the surface. Author

N76-21241*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Mission Engineering Section.
REQUIREMENTS AND CAPABILITIES FOR PLANETARY MISSIONS. VOLUME 2: MARS POLAR ORBITER PENETRATOR 1981
G. G. Ball and T. H. Bird Mar. 1976 12 p refs
(Contract NAS7-100)
(NASA-CR-146583; JPL-SP-43-27-Vol-2) Avail: NTIS HC $3.50 CSCL 22B

The Mars Polar Orbiter/Penetrator 1981 mission, intended to investigate the manner in which Mars has evolved, and which surveys its geochemistry, performs climatological investigations, and attempts to determine the planet's gravitational field, was described. The spacecraft, modified from the Viking Orbiter design, carries a new remote-sensing payload and six penetrators. The penetrators are released from a 2.46-h, 1000-km sun synchronous circular orbit and interrogated daily throughout the 2-year orbital mission. X-band telemetry is used to increase data return. Author

N76-21242*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Applied Mechanics Div.
IMPROVED SPACE RADIATION SHIELDING METHODS
Herbert S. Davis and Thomas M. Jordan 1 Mar. 1976 34 p refs Presented at Winter Meeting of Am. Nucl. Soc., San Francisco, 16-21 Nov. 1975
(Contract NAS7-100)
(NASA-CR-146581; JPL-TM-33-765) Avail: NTIS HC $4.00 CSCL 22B

The computing software that was used to perform the charged particle radiation transport analysis and shielding design for the Mariner Jupiter/Saturn 1977 spacecraft is described. Electron fluences, energy spectra and dose rates obtained with this software are presented and compared with independent computer calculations. Author

N76-21243*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
SATELLITES FOR LIFE SCIENCES
L. E. Giddings Jan. 1976 65 p refs
(Contract NAS9-12200)
(NASA-CR-144475; LEC-7737; JSC-10856) Avail: NTIS HC $4.50 CSCL 22B

The potential of all available satellites for adaptation of earth resources technology to life science problems is summarized. Author.

N76-21244# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Guidance and Control Directorate.
MORE ON IMU SELF-ALIGNMENT TECHNIQUES
J. C. Hung and H. V. White (Tenn. Univ., Knoxville) 30 Sep. 1975 32 p refs
(AD-A018174; RG-76-23) Avail: NTIS CSCL 17/7

This report documents the results of a continued study on platform self-alignment techniques conducted at the Guidance and Control Directorate, U.S. Army Missile Research, Development and Engineering Laboratory, Redstone Arsenal, Alabama. The study was aimed at exploring the latest techniques in platform self-alignment and at developing new approaches which would enhance the successful application of self-alignment principles to the PERSHING platform alignment problem with its unique accuracy and reaction time requirement. The significant results presented in this report are as follows: (1) A most efficient matrix inversion algorithm specially tailored for the parameter correlated least square regression algorithm, (2) sensitivity simulation of the self-alignment accuracy with respect to data size and data section, (3) the correct choice of an analytic model for least square data processing, and (4) the correct relationship between the way time is counted and the least square regression model. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N76-21245*# Martin Marietta Corp., Denver, Colo.
SPACE TUG DOCKING STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
Mar. 1976 49 p 5 Vol.
(Contract NAS8-31542)
(NASA-CR-144239; MCR-76-3-Vol-1) Avail: NTIS HC $4.00 CSCL 22B

Results of a detailed systems analysis of the entire rendezvous and docking operation to be performed by the all-up space tug are presented. Specific areas investigated include: generating of operational requirements and a data base of candidate operational techniques and subsystem mechanizations; selection and ranking of integrated system designs capable of meeting the requirements generated; and definition of this simulation/demonstration program required to select and prove the most effective manual, autonomous, and hybrid rendezvous and docking systems. J.M.S.

N76-21246*# Martin Marietta Corp., Denver, Colo.
SPACE TUG DOCKING STUDY. VOLUME 2: STUDY RESULTS Final Report
Mar. 1976 147 p refs 5 Vol.
(Contract NAS8-31542)
(NASA-CR-144240; MCR-76-3-Vol-2) Avail: NTIS HC $6.00 CSCL 22B

For abstract, see N76-21245.

N76-21247*# Martin Marietta Corp., Denver, Colo.
SPACE TUG DOCKING STUDY. VOLUME 3: PROCEDURES AND PLANS Final Report
Mar. 1976 232 p 5 Vol.
(Contract NAS8-31542)
(NASA-CR-144241; MCR-76-3-Vol-3) Avail: NTIS HC $8.00 CSCL 22B

For abstract, see N76-21245.

N76-21248*# Martin Marietta Corp., Denver, Colo.
SPACE TUG DOCKING STUDY. VOLUME 4: SUPPORTING ANALYSES Final Report
Mar. 1976 262 p refs 5 Vol.
(Contract NAS8-31542)
(NASA-CR-144242; MCR-76-3-Vol-4) Avail: NTIS HC $9.00 CSCL 22B

For abstract, see N76-21245.

N76-21249*# Martin Marietta Corp., Denver, Colo.
SPACE TUG DOCKING STUDY. VOLUME 5: COST ANALYSIS Final Report
Mar. 1976 40 p 5 Vol.
(Contract NAS8-31542)
(NASA-CR-144243; MCR-76-3-Vol-5) Avail: NTIS HC $4.00 CSCL 22B

The cost methodology, summary cost data, resulting cost estimates by Work Breakdown Structure (WBS), technical characteristics data, program funding schedules and the WBS for the costing are discussed. Cost estimates for two tasks of the study are reported. The first, developed cost estimates for design, development, test and evaluation (DDT&E) and theoretical first unit (TFU) at the component level (Level 7) for all items reported in the data base. Task B developed total subsystem DDT&E costs and funding schedules for the three candidate Rendezvous and Docking Systems: manual, autonomous, and hybrid. Author

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N76-21250* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
POSITION DETERMINATION SYSTEMS Patent
Paul W. Shores, inventor (to NASA) Issued 6 Apr. 1976 6 p Filed 28 Nov. 1973 Supersedes N74-14942 (12 - 06, p 0646)
(NASA-Case-MSC-12593-1; US-Patent-3,949,400; US-Patent-Appl-SN-419747; US-Patent-Class-343-100ST; US-Patent-Class-325-14; US-Patent-Class-343-100SA; US-Patent-Class-343-112TC) Avail: US Patent Office CSCL 17G

A system for an orbital antenna, operated at a synchronous altitude, to scan an area of a celestial body is disclosed. The antenna means comprises modules which are operated by a steering signal in a repetitive function for providing a scanning beam over the area. The scanning covers the entire area in a pattern and the azimuth of the scanning beam is transmitted to a control station on the celestial body simultaneous with signals from an activated ground beacon on the celestial body. The azimuth of the control station relative to the antenna is known and the location of the ground beacon is readily determined from the azimuth determinations.
Official Gazette of the U.S. Patent Office

N76-21251*# Business and Technological Systems, Inc., Seabrook, Md.
A SIMULATION FOR GRAVITY FINE STRUCTURE RECOVERY FROM LOW-LOW GRAVSAT SST DATA Final Report
R. H. Estes and E. R. Lancaster (NASA. Goddard Space Flight Center) Jan. 1976 87 p refs
(Contract NAS5-20901)
(NASA-CR-144739; BTS-TR-76-29) Avail: NTIS HC $5.00 CSCL 22C

Covariance error analysis techniques were applied to investigate estimation strategies for the low-low SST mission for accurate local recovery of gravitational fine structure, considering the aliasing effects of unsolved for parameters. A 5 degree by 5 degree surface density block representation of the high order geopotential was utilized with the drag-free low-low GRAVSAT configuration in a circular polar orbit at 250 km altitude. Recovery of local sets of density blocks from long data arcs was found not to be feasible due to strong aliasing effects. The error analysis for the recovery of local sets of density blocks using independent short data arcs demonstrated that the estimation strategy of simultaneously estimating a local set of blocks covered by data and two 'buffer layers' of blocks not covered by data greatly reduced aliasing errors. Author

N76-21252*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
SATELLITE ATTITUDE PREDICTION BY MULTIPLE TIME SCALES METHOD
Yee-Chee Tao and Rudrapatna Ramnath Dec. 1975 205 p refs
(Contract NAS5-20548)
(NASA-CR-144742; R-930) Avail: NTIS HC $7.75 CSCL 22C

An investigation is made of the problem of predicting the attitude of satellites under the influence of external disturbing torques. The attitude dynamics are first expressed in a perturbation formulation which is then solved by the multiple scales approach. The independent variable, time, is extended into new scales, fast, slow, etc., and the integration is carried out separately in the new variables. The theory is applied to two different satellite configurations, rigid body and dual spin, each of which may have an asymmetric mass distribution. The disturbing torques

considered are gravity gradient and geomagnetic. Finally, as multiple time scales approach separates slow and fast behaviors of satellite attitude motion, this property is used for the design of an attitude control device. A nutation damping control loop, using the geomagnetic torque for an earth pointing dual spin satellite, is designed in terms of the slow equation. Author.

N76-21253*# Computer Sciences Corp., Silver Spring, Md. System Sciences Div.
NASA COMPENDIUM OF SATELLITE COMMUNICATIONS PROGRAMS
Dec. 1975 719 p refs
(Contracts NAS5-24011; NAS5-24012)
(NASA-CR-144672) Avail: NTIS HC $18.75 CSCL 17B

A comprehensive review is given of worldwide satellite communication programs that range in time from the inception of satellite communications to mid-1974. Particular emphasis is placed on program results, including experiments conducted, communications system operational performance, and technology employed. The background for understanding these results is established through brief summaries of the program organization, system configuration, and satellite and ground terminal characteristics. Major consideration is given to the communications system aspects of each program, but general spacecraft technology and other experiments conducted as part of the same program are mentioned summarily. Author

N76-21254*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
SATELLITE-TRACKING AND EARTH-DYNAMICS RESEARCH PROGRAMS Semiannual Progress Report, 1 Jul. - 31 Dec. 1974
31 Dec. 1974 70 p refs
(Grant NGR-09-015-002)
(NASA-CR-146811; SAPR-31) Avail: NTIS HC $4.50 CSCL 22C

Observations and research progress of the Smithsonian Astrophysical Observatory are reported. Satellite tracking networks (ground stations) are discussed and equipment (Baker-Nunn cameras) used to observe the satellites is described. The improvement of the accuracy of a laser ranging system of the ground stations is discussed. Also, research efforts in satellite geodesy (tides, gravity anomalies, plate tectonics) is discussed. The use of data processing for geophysical data is examined, and a data base for the Earth and Ocean Physics Applications Program is proposed. Analytical models of the earth's motion (computerized simulation) are described and the computation (numerical integration and algorithms) of satellite orbits affected by the earth's albedo, using computer techniques, is also considered. Research efforts in the study of the atmosphere are examined (the effect of drag on satellite motion), and models of the atmosphere based on satellite data are described. J.R.T.

N76-21255*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
SATELLITE-TRACKING AND EARTH-DYNAMICS RESEARCH PROGRAMS Semiannual Progress Report, 1 Jan. - 30 Jun. 1975
30 Jun. 1975 98 p refs
(Grant NGR-09-015-002)
(NASA-CR-146809; SAPR-32) Avail: NTIS HC $5.00 CSCL 22C

The activities and progress in the satellite tracking and earth dynamics research during the first half of calendar year 1975 are described. Satellite tracking network operations, satellite geodesy and geophysics programs, GEOS 3 project support, and atmospheric research are covered. Author

N76-21256*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
UNITED STATES SOCIETAL EXPERIMENTS VIA THE COMMUNICATIONS TECHNOLOGY SATELLITE
Patrick L. Donoughe 1976 11 p refs To be presented at the Intern. Conf. on Commun., Philadelphia, 14-16 Jun. 1976; Sponsored by IEEE
(NASA-TM-X-73403; E-8716) Avail: NTIS HC $3.50 CSCL 17B

The Communications Technology Satellite (CTS) is a cooperative experimental program of the United States and Canadian governments. The CTS uses a high-power transponder at the frequencies of 14/12 GHz for two-way television and voice communication. The United States and Canada have agreed to share equally in the use of CTS. The U.S. program includes a variety of societal experiments. The ground stations for these experiments are located from the Atlantic to the Pacific. The satellite communications capabilities and the antenna coverage for the U.S. are summarized. Emphasis is placed on the U.S. societal experiments in the areas of education, health care, and community and special services; nine separate experiments are discussed. Author

N76-21257*# Alabama A & M Univ., Normal.
SHUTTLE STATION, AND SATELLITE COMMUNICATIONS PROGRAM Final Technical Report
Leo Lawsine Mar. 1974 10 p
(Grant NGR-01-001-013)
(NASA-CR-146860) Avail: NTIS HC $3.50 CSCL 17B

A parametric approach is developed to analyze and evaluate the performance of any link or links of a satellite relay system. The approach factors into the calculations the constraints of coherent radio frequency interference, multipath, and equipment design. The report is divided into three sections dealing with Spread Spectrum Techniques (Section 1), Power Budget Calculations (Section 2), and Required Capabilities and Design Factors for Tracking and Data Relay Systems TDRS (Section 3). Author.

N76-21258# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Unternehmensbereich Raumfahrt.
STUDY OF THE COMPRESSION OF IMAGE DATA ON BOARD OF AN APPLICATIONS OR SCIENTIFIC SPACECRAFT. VOLUME 1: DESCRIPTION OF THE SIMULATOR AND SUMMARY OF RESULTS
E. Bruederle, H. Baetz, W. Craemer, and H. Weingarten [1975] 57 p refs 3 Vol.
(Contract ESTEC-2120/73-HP)
(ESA-CR(P)-770-Vol-1) Avail: NTIS HC $4.50

The simulator described is for onboard compression of satellite imagery data as part of a complete image transmission system. The image material available is discussed and suitable methods analyzed for input into the computer and for image representation. Picture properties and statistics were analyzed for establishing the parameters to be used in modelling the image. Available modulation techniques were surveyed, and methods based on DPCM selected. Methods are described to display processed images. Physical principles are discussed offering the possibility of redundancy reduction. Numerical results are summarized. ESA

N76-21259# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Unternehmensbereich Raumfahrt.
STUDY ON THE COMPRESSION OF IMAGE DATA ON-BOARD OF AN APPLICATIONS OR SCIENTIFIC SPACECRAFT. VOLUME 2: MATHEMATICAL DERIVATIONS OF COMPRESSION METHODS
E. Bruederle, H. Baetz, W. Craemer, and H. Weingarten [1975] 295 p 3 Vol.
(Contract ESTEC-2120/73-HP)
(ESA-CR(P)-771-Vol-2) Avail: NTIS HC $9.25

The theoretical basis is described of all methods for onboard compression of satellite imagery data as part of a complete image transmission system. The entropy and theoretical redundancy were determined from signal analysis. The possibilities of obtaining models for imagery are discussed, based on transmitting only the random part of the image. It is shown how correlation between picture elements (lines and columns) and between different channels is the basis for redundancy. The basis for an encoding with an average word length equal to the entropy is given. Delta modulations and DPCM are discussed as modulation methods, and bit plane encoding is mentioned. Problems connected with transformation into frequency domain prior to encoding and transmission are treated. Some general problems of multispectral data transmission are dealt with. Buffer control techniques and channel error effects are summarized. ESA

N76-21260# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Unternehmensbereich Raumfahrt.
STUDY ON THE COMPRESSION OF IMAGE DATA ON-BOARD OF AN APPLICATIONS OR SCIENTIFIC SPACECRAFT. VOLUME 3: USER'S MANUAL
E. Bruederle, H. Baetz, W. Craemer, H. Weingarten, and C. M. Allen (ESRTC, Noordwijk, Neth.) [1975] 222 p 3 Vol.
(Contract ESTEC-2120/73-HP)
(ESA-CR(P)-772-Vol-3) Avail: NTIS HC $7.75

A manual is presented for the computerized simulation of the compression of satellite image data and transmission thereof. Explanations are given for practical use of the simulator program. The organization of all subroutines and the significance of all data cards is detailed. ESA

N76-21261# Defense Documentation Center, Alexandria, Va.
COMMUNICATION SATELLITES Report Bibliography, Jan. 1963 - May 1975
Nov. 1975 374 p refs
(AD-A017900; DDC/BIB-75/15) Avail: NTIS CSCL 17/2

This bibliography contains unclassified-unlimited citations on Communication Satellites. Some aspects discussed in this report are performance analysis, statistical analysis and the evaluation of control systems, communication links, transmission systems, navigational aids, and frequency allocations in relation to communication satellites. The four computer-generated indexes provided are Corporate Author-Monitoring Agency, Subject, Title and Personal Author. GRA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-21262*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
POSTFLIGHT ANALYSIS FOR DELTA PROGRAM MISSION NO. 113: COS-B MISSION
20 Feb. 1976 213 p
(Contract NAS7-832)
(NASA-CR-146805; A3-262-AMOO-M75-509) Avail: NTIS HC $7.75 CSCL 22C

On 8 August 1975, the COS-B spacecraft was launched successfully from the Western Test Range (Delta Program Mission No. 113). The launch vehicle was a three stage Extended Long Tank Delta DSV-3P-11B vehicle. Postflight analyses performed in connection with flight are presented. Vehicle trajectory, stage performance, vehicle reliability and the propulsion, guidance, flight control, electronics, mechanical and structural systems are evaluated. Author

N76-21263*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A FUNCTIONAL DESCRIPTION OF A DIGITAL FLIGHT TEST SYSTEM FOR NAVIGATION AND GUIDANCE RESEARCH IN THE TERMINAL AREA
Daniel M. Hegarty Dec. 1974 76 p refs
(NASA-TM-X-62400; A-5819) Avail: From Originating Office Only CSCL 22B

A guidance, navigation, and control system, the Simulated Shuttle Flight Test System (SS-FTS), when interfaced with existing aircraft systems, provides a research facility for studying concepts for landing the space shuttle orbiter and conventional jet aircraft. The SS-FTS, which includes a general-purpose computer, performs all computations for precisely following a prescribed approach trajectory while properly managing the vehicle energy to allow safe arrival at the runway and landing within prescribed dispersions. The system contains hardware and software provisions for navigation with several combinations of possible navigation aids that have been suggested for the shuttle. The SS-FTS can be reconfigured to study different guidance and navigation concepts by changing only the computer software, and adapted to receive different radio navigation information through minimum hardware changes. All control laws, logic, and mode interlocks reside solely in the computer software. Author

N76-21264*# Chrysler Corp., New Orleans, La. Space Div.
AERODYNAMIC RESULTS OF A SEPARATION EFFECTS TEST ON A 0.010-SCALE MODEL (52-OTS) OF THE INTEGRATED SSV IN THE AEDC/VKF 40-BY-40 INCH SUPERSONIC WIND TUNNEL A (IA111), VOLUME 1 Aerothermodynamic Data Report
Ellis Chee (Rockwell Intern. Co., Downey, Calif.) Feb. 1976 793 p refs 2 Vol.
(Contract NAS9-13247)
(NASA-CR-141831; DMS-DR-2242-Vol-1) Avail: NTIS HC $18.75 CSCL 22B

Graphical data obtained during experimental wind tunnel aerodynamic investigations of a 0.010 scale model (52-OTS) of the integrated space shuttle vehicle was presented. The purpose of this investigation was to obtain data with the solid rocket booster (SRB) in proximity to the orbiter/external tank (O/ET), over a large O/ET initial angle of attack and sideslip range, as well as data on the SRB alone (greatly separated from the O/ET). A captive trajectory system, which supported the SRB, was used with the tunnel primary sector (supporting the O/ET) to obtain grid type separation effects data. One symmetrical SRB model was used interchangeably to obtain right-hand and left-hand SRB data. The entire investigation was conducted at a free-stream Mach number of 4.5 at unit Reynolds number of 3.95 and 5.9 million per foot. Author

N76-21265*# Chrysler Corp., New Orleans, La. Space Div.
AERODYNAMIC RESULTS OF A SEPARATION EFFECTS TEST ON A 0.010-SCALE MODEL (52-OTS) OF THE INTEGRATED SSV IN THE AEDC/VKF 40-BY-40 INCH SUPERSONIC WIND TUNNEL A (IA111), VOLUME 2 Aerothermodynamic Data Report
Ellis Chee (Rockwell Intern. Corp., Downey, Calif.) Jan. 1976 941 p refs 2 Vol.
(Contract NAS9-13247)
(NASA-CR-144588; DMS-DR-2242-Vol-2) Avail: NTIS HC $23.75 CSCL 22B

Tabular data obtained during experimental wind tunnel aerodynamic investigations of a 0.010 scale model (52-OTS) of the integrated space shuttle vehicle was presented. The purpose of this investigation was to obtain data with the solid rocket booster (SRB) in proximity to the orbiter/external tank (O/ET), over a large O/ET initial angle of attack and sideslip range, as well as data on the SRB alone (greatly separated from the O/ET). A captive trajectory system, which supported the SRB, was used with the tunnel primary sector (supporting the O/ET) to obtain grid type separation effects data. One symmetrical SRB model was used interchangeably to obtain right-hand and left-hand SRB data. The entire investigation was conducted at free-stream Mach number of 4.5 at unit Reynolds number of 3.95 and 5.9 million per foot. Author

N76-21266*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF HEAT TRANSFER TESTS ON A 0.0175-SCALE SPACE SHUTTLE ORBITER MODEL (56-0) IN THE AEDC VKF 'B' HYPERSONIC WIND TUNNEL (OH74) Aerothermodynamic Data Report
W. H. Dye (Rockwell Intern. Corp., Downey, Calif.) Feb. 1976 607 p refs
(Contract NAS9-13247)
(NASA-CR-144596; DMS-DR-2263) Avail: NTIS HC $16.25 CSCL 22B

The results are presented of aerodynamic heating tests conducted on a 0.0175-scale model of the space shuttle orbiter. The tests were conducted at a nominal Mach number of 8 and model angles of attack varying between 20 deg and 45 deg. Author

N76-21267*# Boeing Aerospace Co., Seattle, Wash. Research and Engineering Div.
METHODS FOR COMBINING PAYLOAD PARAMETER VARIATIONS WITH INPUT ENVIRONMENT Draft Interim Report

D. H. Merchant and J. W. Straayer 31 Dec. 1975 73 p refs (Contract NAS8-31240)
(NASA-CR-144245; D180-19275-1) Avail: NTIS HC $4.50 CSCL 22B

Methods are presented for calculating design limit loads compatible with probabilistic structural design criteria. The approach is based on the concept that the desired limit load, defined as the largest load occuring in a mission, is a random variable having a specific probability distribution which may be determined from extreme-value theory. The design limit load, defined as a particular value of this random limit load, is the value conventionally used in structural design. Methods are presented for determining the limit load probability distributions from both time-domain and frequency-domain dynamic load simulations. Numerical demonstrations of the methods are also presented. Author

N76-21268*# National Aeronautics and Space Administration, Washington, D.C.
THE APOLLO SPACECRAFT: A CHRONOLOGY, VOLUME 3, 1 OCTOBER 1964 - 20 JANUARY 1966
Courtney G. Brooks and Ivan D. Ertel 1976 296 p refs
(NASA-SP-4009-Vol-3; LC-69-60008) Avail: NTIS MF $2.25; SOD HC $5.20 CSCL 22B

The development of the Apollo spacecraft is traced along with that of Saturn V. Emphasis is placed on the detailed engineering design and exhaustive testing performed to qualify both the command and service modules and the lunar module for manned flight. Author

N76-21269*# Chrysler Corp., New Orleans, La. Space Div.
RESULTS OF HEAT TRANSFER TESTS OF AN 0.0175-SCALE SPACE SHUTTLE VEHICLE MODEL 22 OTS IN THE NASA-AMES 3.5-FOOT HYPERSONIC WIND TUNNEL (IH3), VOLUME 4 Aerothermodynamic Data Report
Thomas F. Foster (Rockwell Intern. Corp., Downey, Calif.) and William K. Lockman (NASA. Ames Res. Center) Apr. 1975 367 p refs
(Contract NAS9-13247)
(NASA-CR-141517; DMS-DR-2136-Vol-4) Avail: NTIS HC $10.50 CSCL 22B

Heat-transfer data for the 0.0175-scale Space Shuttle Vehicle 3 are presented. Interference heating effects were investigated by a model build-up technique of Orbiter alone, tank alone, second, and first stage configurations. The test program was conducted in the NASA-Ames 3.5-Foot Hypersonic Wind Tunnel at Mach 5.3 for nominal free-stream Reynolds number per foot values of 1.5 x 1,000,000 and 5.0 x 1,000,000. Author

N76-21270# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.
ARIANE INTERSTAGE 2/3: STRESS ANALYSIS - FIRST LOOP (FEA-1)
H. Akister 23 Nov. 1974 121 p refs
(FOK-RV-74-115) Avail: NTIS HC $5.50

Results of the finite element displacement analysis were investigated with respect to allowable loads and stresses. Margins of safety are presented and from these it is concluded that the structure as designed should be satisfactory. Author (ESA)

N76-21271# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.
ARIANE INTERSTAGE 1/2: STRESS ANALYSIS - FIRST LOOP (FEA-1)
F. W. Olivier 13 Feb. 1975 136 p refs
(FOK-RV-74-116) Avail: NTIS HC $6.00

Results of the finite element analysis were investigated with respect to allowable loads and stresses. Margins of safety are presented, and from these it is concluded that the structure as designed should be satisfactory. Author (ESA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N76-21272*# ITT Aerospace/Optical Div., Fort Wayne, Ind.
HIGH RESOLUTION INFRARED RADIATION SOUNDER (HIRS) FOR THE NIMBUS F SPACECRAFT Final Report, Oct. 1971 - Jul. 1975
Edward W. Koenig Dec. 1975 286 p
(Contract NAS5-21651)
(NASA-CR-144743) Avail: NTIS HC $9.25 CSCL 14B

Flown on Nimbus F in June 1975, the high resolution infrared radiation sounder (HIRS) scans with a geographical resolution of 23KM and samples radiance in seventeen selected spectral channels from visible (.7 micron) to far IR (15 micron). Vertical temperature profiles and atmospheric moisture content can be inferred from the output. System operation and test results are described. Author

N76-21273*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRELIMINARY DESIGN AND PERFORMANCE OF AN ADVANCED GAMMA RAY SPECTROMETER FOR FUTURE ORBITER MISSIONS
A. E. Metzger (JPL), R. H. Parker (JPL), J. R. Arnold (Calif. Univ., San Diego), R. C. Reedy (Los Alamos Sci. Lab.), and J. I. Trombka 7 May 1975 29 p refs Presented at 6th Lunar Sci. Conf., Houston, Tex., 17 Mar. 1975
(Contract W-7405-eng-36)
(NASA-TM-X-73064; LA-UR-75-880; Conf-750344-2) Avail: NTIS HC $4.50

A knowledge of the composition of planets, satellites, and asteroids is of primary importance in understanding the formation and evolution of the solar system. Gamma-ray spectroscopy is capable of measuring the composition of meter-depth surface material from orbit around any body possessing little or no atmosphere. Measurement sensitivity is determined by detector efficiency and resolution, counting time, and the background flux while the effective spatial resolution depends upon the field-of-view and counting time together with the regional contrast in composition. The advantages of using germanium as a detector of gamma rays in space are illustrated experimentally and a compact instrument cooled by passive thermal radiation is described. Calculations of the expected sensitivity of this instrument at the Moon and Mars show that at least a dozen elements will be detected, twice the number which have been isolated in the Apollo gamma-ray data. Author (NSA)

N76-21274# Tri-Con Associates, Inc., Cambridge, Mass.
THE DESIGN DEVELOPMENT AND TEST OF SATELLITE AND BALLOON-BORN MASS SPECTROMETERS Interim Report
George P. Murphy L. G. Hanscom Field, Mass. AFCRL Sep. 1975 20 p
(Contract F19628-73-C-0192; AF Proj. 6687)
(AD-A018099; AFCRL-TR-75-0492; SR-2) Avail: NTIS CSCL 14/2

This report covers the work done in development of electronic instrumentation which will be used on satellite and balloon flights to measure ion species in the ionosphere and stratosphere. The satellite instrument is designed to measure both neutral and positive ion constituents from 1 AMU to 44 AMU. The balloon instrument is designed to measure positive ions in the range of 10 AMU to 400 AMU. GRA

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N76-21275* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SYSTEM FOR IMPOSING DIRECTIONAL STABILITY ON A ROCKET-PROPELLED VEHICLE Patent

Harold Perkins, inventor (to NASA) Issued 6 Apr. 1976 6 p Filed 31 Jul. 1974 Supersedes N74-30311 (12 - 19, p 2353)

(NASA-Case-MFS-21311-1; US-Patent-3,948,470; US-Patent-Appl-SN-493359; US-Patent-Class-244-3.22) Avail: US Patent Office CSCL 21H

An improved system for use in imposing directional stability on a rocket-propelled vehicle is described. The system includes a pivotally supported engine-mounting platform, a gimbal ring mounted on the platform and adapted to pivotally support a rocket engine and an hydraulic actuator connected to the platform for imparting selected pivotal motion. An accelerometer and a signal comparator circuit for providing error intelligence indicative of aberration in vehicle acceleration is included along with an actuator control circuit connected with the actuator and responsive to error intelligence for imparting pivotal motion to the platform. Relocation of the engine's thrust vector is thus achieved for imparting directional stability to the vehicle.

Official Gazette of the U.S. Patent Office

N76-21276* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

METHOD OF CONSTRUCTING DISHED ION THRUSTER GRIDS TO PROVIDE HOLE ARRAY SPACING COMPENSATION Patent

Bruce A. Banks, inventor (to NASA) Issued 6 Apr. 1976 4 p Filed 20 Jan. 1975 Supersedes N75-16624 (13 - 08, p 0863)

(NASA-Case-LEW-11876-1; US-Patent-3,947,933; US-Patent-Appl-SN-542157; US-Patent-Class-29-25.18) Avail: US Patent Office CSCL 21C

The center-to-center spacings of a photoresist pattern for an array of holes applied to a thin metal sheet are increased by uniformly stretching the thin metal sheet in all directions along the plane of the sheet. The uniform stretching is provided by securely clamping the periphery of the sheet and applying an annular force against the face of the sheet, within the periphery of the sheet and around the photoresist pattern. The technique is used in the construction of ion thruster grid units where the outer or downstream grid is subjected to uniform stretching prior to convex molding. The technique provides alignment of the holes of grid pairs so as to direct the ion beamlets in a direction parallel to the axis of the grid unit and thereby provide optimization of the available thrust. Official Gazette of the U.S. Patent Office

N76-21277+ Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.

STRESS ANALYSIS OF SURROUNDINGS OF THE HOLE OF THE N2 AND O2 VALVE UNITS

F. W. Olivier 4 Jul. 1975 36 p refs

(FOK-RV-75-59) Avail: NTIS HC $4.00

A finite element analysis was performed in the cylindrical part of the Ariane third stage engine frame. Some relevant stresses and displacements due to a uniform axial running load and a radial force and tangential moment on the valve units are calculated. Special attention is paid to the stress distribution in the lower part of the tank skirt above the hole. ESA

N76-21278*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Propulsion Div.

SIMULATION OF AN ION THRUSTER CONTROL SYSTEM

I. Kudo (Electrotech. Lab., Tokyo), L. C. Pless, and E. V. Pawlik 15 Feb. 1976 47 p refs

(Contract NAS7-100)

(NASA-CR-146580; JPL-TM-33-755) Avail: NTIS HC $4.00 CSCL 21C

The results of an initial effort to model the control loops of a 30-cm diameter electron bombardment thruster and a transistorized power processor predicting its operation were described. Data from which the model is made is presented as well as comparisons between the computer outputs and test data from the JPL Solar Electric Propulsion systems laboratory. Author

N76-21279*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

SUPERSONIC FLOW OF CHEMICALLY REACTING GAS-PARTICLE MIXTURES. VOLUME 2: RAMP, A COMPUTER CODE FOR ANALYSIS OF CHEMICALLY REACTING GAS-PARTICLE FLOWS

Morris M. Penny, Sheldon D. Smith, Peter G. Anderson, Peter R. Sulyma, and Marcus L. Pearson Jan. 1976 448 p refs 2 Vol.

(Contract NAS9-14517)

(NASA-CR-147532; LMSC-HREC-TR-D496555-Vol-2) Avail: NTIS HC $11.75 CSCL 21H

A computer program written in conjunction with the numerical solution of the flow of chemically reacting gas-particle mixtures was documented. The solution to the set of governing equations was obtained by utilizing the method of characteristics. The equations cast in characteristic form were shown to be formally the same for ideal, frozen, chemical equilibrium and chemical non-equilibrium reacting gas mixtures. The characteristic directions for the gas-particle system are found to be the conventional gas Mach lines, the gas streamlines and the particle streamlines. The basic mesh construction for the flow solution is along streamlines and normals to the streamlines for axisymmetric or two-dimensional flow. The analysis gives detailed information of the supersonic flow and provides for a continuous solution of the nozzle and exhaust plume flow fields. Boundary conditions for the flow solution are either the nozzle wall or the exhaust plume boundary. Author

N76-21280*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

SUPERSONIC FLOW OF CHEMICALLY REACTING GAS-PARTICLE MIXTURES. VOLUME 1: A THEORETICAL ANALYSIS AND DEVELOPMENT OF THE NUMERICAL SOLUTION

Morris M. Penny, Sheldon D. Smith, Peter G. Anderson, Peter R. Sulyma, and Marcus L. Pearson Jan. 1976 204 p refs 2 Vol.

(Contract NAS9-14517)

(NASA-CR-147531; LMSC-HREC-TR-D496555-Vol-1) Avail: NTIS HC $7.75 CSCL 21H

A numerical solution for chemically reacting supersonic gas-particle flows in rocket nozzles and exhaust plumes was described. The gas-particle flow solution is fully coupled in that the effects of particle drag and heat transfer between the gas and particle phases are treated. Gas and particles exchange momentum via the drag exerted on the gas by the particles. Energy is exchanged between the phases via heat transfer (convection and/or radiation). Thermochemistry calculations (chemical equilibrium, frozen or chemical kinetics) were shown to be uncoupled from the flow solution and, as such, can be solved separately. The solution to the set of governing equations is obtained by utilizing the method of characteristics. The equations cast in characteristic form are shown to be formally the same for ideal, frozen, chemical equilibrium and chemical non-equilibrium reacting gas mixtures. The particle distribution is represented in the numerical solution by a finite distribution of particle sizes.

Author

N76-21281*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

SPACE SHUTTLE SRM PLUME EXPANSION SENSITIVITY ANALYSIS

Sheldon D. Smith, James A. Tevepaugh, and Morris M. Penny Nov. 1975 51 p refs

(Contract NAS9-14517)

(NASA-CR-147528; LMSC-HREC-TM-D496636) Avail: NTIS HC $4.50 CSCL 21H

The exhaust plumes of the space shuttle solid rocket motors can have a significant effect on the base pressure and

base drag of the shuttle vehicle. A parametric analysis was conducted to assess the sensitivity of the initial plume expansion angle of analytical solid rocket motor flow fields to various analytical input parameters and operating conditions. The results of the analysis are presented and conclusions reached regarding the sensitivity of the initial plume expansion angle to each parameter investigated. Operating conditions parametrically varied were chamber pressure, nozzle inlet angle, nozzle throat radius of curvature ratio and propellant particle loading. Empirical particle parameters investigated were mean size, local drag coefficient and local heat transfer coefficient. Sensitivity of the initial plume expansion angle to gas thermochemistry model and local drag coefficient model assumptions were determined. Author

N76-21282*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

SUMMARY OF NOZZLE-EXHAUST PLUME FLOWFIELD ANALYSES PERFORMED IN SUPPORT OF SPACE SHUTTLE APPLICATIONS Final Report

Sheldon D. Smith and Peter R. Sulyma Jan. 1976 21 p refs
(Contract NAS9-14517)
(NASA-CR-147529; LMSC-HREC-TR-D496700) Avail: NTIS HC $3.50 CSCL 21H

Results are summarized of various analyses of the exhaust plumes of the space shuttle. Specific topics discussed included: the development of the two-phase plume flow field model, including finite rate chemistry and free molecular effects; analyses of exhaust plume simulation studies; verification of the analytical two-phase plume flow field model; and complete documentation of the two-phase plume computer code. J.M.S.

N76-21283*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

ASSESSMENT OF ANALYTICAL AND EXPERIMENTAL TECHNIQUES UTILIZED IN CONDUCTING PLUME TECHNOLOGY TESTS 575 AND 593

L. R. Baker, P. R. Sulyma, J. A. Tevepaugh, and M. M. Penny Jan. 1976 85 p refs
(Contract NAS9-14517)
(NASA-CR-147530; LMSC-HREC-TM-D496602) Avail: NTIS HC $5.00 CSCL 21H

Since exhaust plumes affect vehicle base environment (pressure and heat loads) and the orbiter vehicle aerodynamic control surface effectiveness, an intensive program involving detailed analytical and experimental investigations of the exhaust plume/vehicle interaction was undertaken as a pertinent part of the overall space shuttle development program. The program, called the Plume Technology program, has as its objective the determination of the criteria for simulating rocket engine (in particular, space shuttle propulsion system) plume-induced aerodynamic effects in a wind tunnel environment. The comprehensive experimental program was conducted using test facilities at NASA's Marshall Space Flight Center and Ames Research Center. A post-test examination of some of the experimental results obtained from NASA-MSFC's 14 x 14-inch trisonic wind tunnel is presented. A description is given of the test facility, simulant gas supply system, nozzle hardware, test procedure and test matrix. Analysis of exhaust plume flow fields and comparison of analytical and experimental exhaust plume data are presented. Author

N76-21284# Royal Aircraft Establishment, Farnborough (England).

COMPARATIVE DEEP THERMAL CYCLING OF SOLAR CELL PANELS Final Report

F. C. Treble, A. F. Dunnet, and A. A. Dollery Feb. 1974 53 p ref
(Contract ESTEC-1533/71-AA)
(RAE-TM-SPACE-210; ESRO-CR(P)-434) Avail: NTIS HC $4.50

To compare the geostationary environmental capability of modern lightweight rigid and flexible solar cell panels from four European manufacturers, samples of each type were subjected to 500 deep thermal cycles simulating geostationary conditions. The panels were assessed by periodic visual inspections and performance tests at room temperature. All the flexible panels, soldered and welded, cemented and cementless and with wraparound and conventional cell contacts, survived the test with little apparent damage and no performance degradation. Two of the rigid panels also survived but one, with very thin cells and a thick layer of mounting cement, sustained damage to the cells, interconnects, joints and adhesive bond and the other showed progressive distortion and fracture of the silver mesh interconnects and busbars. It would be instructive to continue the test to at least 2,000 cycles before final assessment, to simulate geostationary missions where the solar array is subject to self-shadowing. Author (ESA)

N76-21285# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

THRUST AUGMENTING EJECTORS Technical Interim Report; Jan. - Jun. 1975

Hermann Viets Jun. 1975 197 p refs
(AF Proj. 7116)
(AD-A017782; ARL-75-0224) Avail: NTIS CSCL 21/8

An overview of ejectors as thrust augmentors is presented including the motivation for and operation of thrust augmenting ejectors. Background studies involving jet mixing and diffusion studies are included as well as the state of the art in unsteady jet interactions. Examples of V/STOL aircraft designs incorporating thrust augmenting ejectors are shown and their advantages discussed. Author (GRA)

N76-21286# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

V. P. GLUSHKO TALKS ABOUT ROCKET ENGINES

V. Golovachev 14 Nov. 1975 13 p Transl. into ENGLISH from Trud (Moscow), no. 176 p 3
(AD-A017931; FTD-ID(RS)I-2325-75) Avail: NTIS CSCL 21/8

Development of the liquid propellant rocket engine in the U.S.S.R. is briefly reviewed. Emphasis is placed on their use in aviation, manned space flight, and on interplanetary orbital stations. J.M.S.

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N76-21287*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AN OXIDE DISPERSION STRENGTHENED Ni-W-Al ALLOY WITH SUPERIOR HIGH TEMPERATURE STRENGTH

Thomas K. Glasgow 1976 13 p refs Proposed for presentation at Third Intern. Symp., Seven Springs, Pa., 12-15 Sep. 1976; sponsored by Am. Inst. of Mining, Met. and Petrol. Engrs.
(NASA-TM-X-71888; E-8669) Avail: NTIS HC $3.50 CSCL 11D

An experimental oxide dispersion strengthened (ODS) alloy, WAZ-D, derived from the WAZ-20 composition was produced by the mechanical alloying process. Cast WAZ-20 is strengthened by both a high refractory metal content, and 70 volume percent of gamma prime. The ODS alloy WAZ-D was responsive to variables of alloy content, of attritor processing, of consolidation by extrusion, and of heat treatment. The best material produced had large highly elongated grains. It exhibited tensile strengths generally superior to a comparable cast alloy. The ODS alloy exhibited high temperature stress rupture life considerably superior to any known cast superalloy. Tensile and rupture ductility were low, as was intermediate temperature rupture life. Very low creep rates were noted and some specimens failed with essentially no third stage creep. Also the benefit derived from the oxide

dispersion, far out-weighed that from the elongated microstructure alone. Author

N76-21288*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TIME TEMPERATURE-STRESS DEPENDENCE OF BORON FIBER DEFORMATION
James A. DiCarlo Washington 1976 35 p refs Presented at 4th Conf. on Composite Materials Testing and Design, Valley Forge, Pa., 3-4 May 1976; sponsored by Am. Soc. for Testing and Materials
(NASA-TM-X-71907; E-8698) Avail: NTIS HC $4.00 CSCL 11D

Flexural stress relaxation (FSR) and flexural internal friction (FIF) techniques were employed to measure the time-dependent deformation of boron fibers from -190 to 800 C. The principal specimens were 203 micrometers diameter fibers commercially produced by chemical vapor deposition (CVD) on a 13 micrometer tungsten substrate. The observation of complete creep strain recovery with time and temperature indicated that CVD boron fibers deform flexurally as anelastic solids with no plastic component. Author.

N76-21289*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROGRESS IN ADVANCED HIGH TEMPERATURE MATERIALS TECHNOLOGY
John C. Freche and G. Mervin Ault 1976 33 p refs Proposed for presentation at 3d Intern. Symp. on Superalloys, Seven Springs, Pa., 12-15 Sep. 1976; sponsored by Am. Inst. of Mining, Metallurgical and Petroleum Engr.
(NASA-TM-X-71901) Avail: NTIS HC $4.00 CSCL 11D

Significant progress has recently been made in many high temperature material categories pertinent to such applications by the industrial community. These include metal matrix composites, superalloys, directionally solidified eutectics, coatings, and ceramics. Each of these material categories is reviewed and the current state-of-the-art identified, including some assessment, when appropriate, of progress, problems, and future directions. Author

N76-21290# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
THE STRENGTH OF VISCOELASTIC MATERIALS IN ISOTHERMAL DEFORMATION
Markus Reiner Dec. 1975 73 p refs
(TAE-264) Avail: NTIS HC $4.50

A thermodynamics theory of strength is developed for cases of isothermal deformation. The materials considered are either viscous liquids which exhibit an elastic response, or elastic solids which show viscous resistance to the rate of deformation or, and in general, materials which can act in one way or the other in accordance with given circumstances. The development of the theory is semi-historical, starting with a review of the classical criteria of greatest tension and extension, maximum shearing stress, and maximum stress work. In the thermodynamics theory linear bodies of the Kelvin, Maxwell, and Burgers types are treated along with anelasticity with step loading and constant rate of strain-loading. This leads to the most general case of a combination of linear bodies and the plasticity of the Reiner-fluid. Author

N76-21291*# Fiber Science, Inc., Gardena, Calif.
FILAMENT-WOUND SPAR SHELL GRAPHITE/EPOXY FAN BLADES
Sam Yao Feb. 1976 25 p
(Contract NAS3-17822)
(NASA-CR-134899; FSI-551-201) Avail: NTIS HC $3.50 CSCL 11D

The methodology for fabrication of wet filament wound spar shell fan blades is presented. All principal structural elements were filament wound, assembled, formed, bonded and co-cured in a female mold. A pair of blades were fabricated as one integral unit and parted into two after curing. Author

N76-21292*# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
FURTHER DEVELOPMENT OF HIGH TEMPERATURE-RESISTANT GRAPHITE FIBER COUPLING AGENTS
R. N. Griffin Mar. 1976 57 p refs
(Contract NAS3-18931)
(NASA-CR-134987) Avail: NTIS HC $4.50 CSCL 11D

Potential coupling agents for graphite fibers were screened by their effect on the weight losses of Thornel 300, HMS, and HTS fibers at 588K for 200 and 400 hours. Unidirectional laminates were made from HMS and HTS fibers, untreated, and treated with each of the seven coupling agents. The matrix of all laminates was PMR polyimide (PMR-PR). On the basis of the best overall retention of elevated temperature interlaminar shear strength after 200 hours at 588K, composite weight after 200 hours at 588K, and fiber weight after 400 hours at 588K, ventromer T-1 applied from aqueous solution and pyrolyzed PPQ were selected for further evaluation as coupling agents for HTS fiber while ventromer T-2 and pyrolyzed PPQ were selected as coupling agents for HMS fiber. It was shown that pyrolyzed PPQ as a coupling agent improves the oxidative stability of HTS/PMR-PI composites. Author

N76-21293*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LONGITUDINAL RESIDUAL STRESSES IN BORON FIBERS
D. R. Behrendt 1976 16 p refs Presented at the Symp. on Composite Mater. Testing and Design, Valley Forge, Pa., 3-4 May 1976; sponsored by ASTM
(NASA-TM-X-73402; E-8725) Avail: NTIS HC $3.50 CSCL 11D

A method of measuring the longitudinal residual stress distribution in boron fibers is presented. The residual stresses in commercial CVD boron on tungsten fibers of 102, 142, and 203 microns (4, 5.6, and 8 mil) diameters were determined. Results for the three sizes show a compressive stress at the surface [800 to -1400 MN/sq m 120 to -200] ksi), changing monotonically to a region of tensile stress within the boron. At approximately 25 percent of the original radius, the stress reaches a maximum tensile [600 to 1000 MN/sq m(90 to 150 ksi)] and then decreases to compressive near the tungsten boride core. The core itself is under a compressive stress of approximately -1300 MN/sq m (-190 ksi). The effects of surface removal on core residual stress and core-initiated fracture are discussed. Author

N76-21294*# National Aeronautics and Space Administration, Washington, D.C.
COMPOSITE MATERIALS: A COMPILATION Technology Utilization
Jan. 1976 25 p refs
(NASA-SP-5974(03)) Avail: NTIS HC $1.00 CSCL 11D

Design, analysis and fabrication techniques for boron-aluminum composite-structure technology is presented and a new method of joining different laminated composites without mechanical fasteners is proposed. Also discussed is a low-cost procedure for rigidifying expanded honeycomb tubing and piping simulations. A brief note on patent information is added. L.S.

N76-21510* Harry Diamond Labs., Adelphi, Md.
HIGH PHOTOVOLTAGES IN FERROELECTRIC CERAMICS
Philip S. Brody *In* NASA. Ames Res. Center 2d NASA Conf. on Laser Energy Conversion 1976 p 49-59 refs (For availability see N76-21505 12-36)
CSCL 11B

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N76-21295 Engineering Sciences Data Unit, London (England).
THERMAL CONDUCTIVITY OF LIQUID ALIPHATIC ALCOHOLS

Nov. 1975 15 p
(ESDU-75024) For information on availability of series, sub-series and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $170.50

This data item presents values of thermal conductivity at saturation pressure, in both tabular and graphical form, for the straight and branched chain alkanols which have the general formula CnH(2n+1)OH. The data on which these values are based are the most reliable available, and the range covered is from the melting point, glass transition or the pour point to approximately 0.9 of the critical temperature. In common with other ESDU data items, quantities are expressed in SI Units, and conversion factors to other units are provided. The procedure used to obtain the values of thermal conductivity is described, and the effect of pressure is indicated. An explanation of the tables and figures is given, and the uncertainties in the values presented in them is indicated. ESDU

N76-21296 Engineering Sciences Data Unit, London (England).
VAPOUR PRESSURES AND CRITICAL POINTS OF PURE SUBSTANCES. 6: C3 TO C15 ALIPHATIC KETONES
Nov. 1975 29 p
(ESDU-75025) For information on availability of series, sub-series and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $290.50

This data item presents saturated vapor pressures in both tabular and graphical form of the ketones. All quantities are expressed in SI units, in this case kN/sq m and Kelvins, but for users who continue to require data in mmHg and degrees C some data are given in these units, and conversion factors to other units are provided. The procedures used to derive the values of vapor pressure are presented. The values of vapor pressure given in the tables were obtained by evaluating, for each compound, an equation in the form of a series of Chebyshev polynomials fitted to the selected or estimated data. As with previous items on vapor pressure a single equation is given from .001KN/sq m to the critical point. ESDU

N76-21297# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
CALCULATION OF THE IGNITION DELAY TIMES FOR METHANE-OXYGEN-NITROGEN RES
Alexander Burcat Dec. 1975 16 p refs
(TAE-263) Avail: NTIS HC $3.50

The experimental ignition delay values of methane-oxygen argon and nitrogen dioxide mixtures are confirmed and explained with the help of calculated ignition delay data. Calculation was done using a computer program with 38 reactions whose values were taken from the literature. Only two of these reactions were iteratively fitted and their rates were found to be 2.4x10 to the 12th power cc/mole sec for CH3 + NO2 yields NO + CH3O and 1.0x10 to the 11th power cc/mole sec for the CH3O + O2 yields CH2O + HO2 reaction. Author

N76-21298*# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
OSCILLATORY COMBUSTION OF LIQUID MONOPROPELLANT DROPLETS
S. P. Chanin and G. M. Faeth Mar. 1976 129 p refs
(Grant NGR-39-009-077)
(NASA-CR-134983) Avail: NTIS HC $6.00 CSCL 21B

A theoretical investigation was conducted on the open-loop combustion response of monopropellant droplets and sprays to imposed pressure oscillations. The theoretical model was solved as a perturbation analysis through first order, yielding linear response results. Unsteady gas phase effects were considered in some cases, but the bulk of the calculations assumed a quasi-steady gas phase. Calculations were conducted using properties corresponding to hydrazine decomposition. Zero-order results agreed with earlier measurements of hydrazine droplet burning in combustion gases. The droplet response was greatest (exceeding unity in some cases) for large droplets with liquid phase temperature gradients; at frequencies near the characteristic frequency of the liquid phase thermal wave. The response of a spray is less than that of its largest droplet, however, a relatively small percentage of large droplets provides a substantial response (exceeding unity in some cases). Author

N76-21299*# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
INVESTIGATION OF CRITICAL BURNING OF FUEL DROPLETS Annual Report, 1975
S. P. Chanin, A. J. Shearer, and G. M. Faeth Mar. 1976 47 p refs
(Grant NGR-39-009-077)
(NASA-CR-135006) Avail: NTIS HC $4.00 CSCL 21B

An earlier analysis for the combustion response of a liquid monopropellant strand (hydrazine) was extended to consider individual droplets and sprays. While small drops gave low or negative response, large droplets provided response near unity at low frequencies, with the response declining at frequencies greater than the characteristic liquid phase frequency. Temperature gradients in the liquid phase resulted in response peaks greater than unity. A second response peak was found for large drops which corresponded to gas phase transient effects. Spray response was generally reduced from the response of the largest injected droplet, however, even a small percentage of large droplets can yield appreciable response. An apparatus was designed and fabricated to allow observation of bipropellant fuel spray combustion at elevated pressures. A locally homogeneous model was developed to describe this combustion process which allows for high pressure phenomena associated with the thermodynamic critical point. Author

N76-21300# Union Carbide Corp., Oak Ridge, Tenn. Nuclear Div.
ANALYSIS AND CALCULATION OF SPECIES SEPARATION IN A SUPERSONIC FLOW OF A GAS MIXTURE THROUGH A CURVED SHOCK WAVE
W. L. Harris, J. N. Tunstall, and J. H. Burris Feb. 1975 118 p refs
(Contract W-7405-eng-26)
(UCCND-CSD-10) Avail: NTIS HC $5.45

The technical accomplishments of efforts to synthesize existing theoretical models of shock wave phenomena in order to predict species separation in gas mixtures in supersonic flow through curved, two dimensional shock waves are summarized. The results reported are consistent with the structure of the shock being governed by the Navier-Stokes equations. The implication is, in this case, that the flow is not rarefied. The results are not limited by mass ratio or mole fraction of the species in the binary mixture. The species are assumed to be nonreacting (chemically inert). The effects of Mach number, initial mole fraction, Reynolds number, mass ratio, and shock standoff distance are described. Details of the required digital computations, including a documented numerical code, are also described. Author (NSA)

N76-21301# Los Alamos Scientific Lab., N.Mex.
SYSTEM FOR STUDYING THE INITIAL STATES OF GAS-METAL REACTIONS
G. H. Andrews, Jr., R. M. Alire, and A. W. Czanderna 1975 11 p refs Presented at the 22d Natl. Vacuum Symp., Philadelphia
(Contract W-7405-eng-36)
(LA-UR-75-1628; Conf-751023-1) Avail: NTIS HC $4.00

An ultrahigh vacuum system was constructed for use in conjunction with a Rodder ultramicrobalance for gravimetric studies of metal-gas reactions. Though intended specifically for the study of the early stages of uranium oxidation, the apparatus and techniques are readily adaptable to other metal-gas systems. The system is pumped by sorption, titanium sublimation, and noble ion pumps, which avoid the need for oil diffusion pumping thus eliminating the possibility of sample contamination by oil vapor. Provisions for in situ sputter cleaning of samples as well as electron beam heating and infrared thermometry were built into the system. Gas compositions are monitored with a residual gas analyzer. (NSA)

N76-21302# Worcester Polytechnic Inst., Mass.
GAS PHASE RADIOLYSIS AND VACUUM ULTRAVIOLET PHOTOLYSIS OF HETEROCYCLIC ORGANIC COMPOUNDS Progress Report, 1 Feb. 1974 - 1 Feb. 1975
Alfred A. Scala, Delmar Solomon, Ismael Colon, and Jay DAngona 1975 26 p refs
(Contract AT(11-1)-3569)
(COO-3569-4) Avail: NTIS HC $4.50

In the gamma radiolysis of tetrahydrofuran there are pronounced density effects in the pressure range from 0 to 50 Torr with the most important ion-pair yields decreasing as the pressure increases. The relative product yields of the radiolysis are compared with that of xenon photolysis. Possible mechanisms to explain the results obtained are discussed. The ion-pair yields from the gamma radiolysis of the heterocyclic amines, ethylenimine, azetidine, pyrrolidine, and piperidine, are determined, and the pressure effects are evaluated. Reactions mechanisms are discussed. The vacuum ultraviolet photolysis products of thietane and tetrahydrothiophene are studied and compared with gamma radiolysis products. Reaction mechanisms are discussed. The status of the construction of a photoionization mass spectrometer and the measurement of the ionization efficiencies and extinction coefficients of organic compounds is reported. NSA

N76-21303# New York Univ., N.Y. Dept. of Physics.
INTERACTION OF RADIATION WITH MATTER Progress Report, 1 Aug. 1974 - 31 Jul. 1975
Mar. 1975 100 p refs Sponsored by ERDA
(TID-26777) Avail: NTIS HC $8.00

Studies on the energy and charge transfer processes that occur in organic solids as a result of the absorption of radiation in the energy range from approximately 1 eV to 25 MeV are reported. A dominant feature is the use of an external magnetic field to examine the properties of triplet excitons in ordered solids. Studies on triplet probes, luminescence, and charge carriers are reported. Future research planned in these areas is extensively described. A list of publications resulting from the research is appended. NSA

N76-21304# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. Fuer Chemie.
RADIATION-CHEMICAL CROSS-LINKING OF POLYETHYLENES
R. Schaudy Jul. 1974 23 p refs In GERMAN
(SGAE-2305) Avail: ERDA Depository Libraries HC $4.25

A review is given of the chemistry of the radiation-induced cross-linking of polyethylenes and the factors affecting it. The property changes obtained from crosslinking (solubility, thermal stability, mechanical properties, and electrical properties) and the most important technological problems are dicusssed. NSA

N76-21305# Cornell Univ., Ithaca, N.Y. Dept. of Theoretical and Applied Mechanics.
WEAK BURNING OF A LIQUID FUEL DROP
John D. Buckmaster Nov. 1974 32 p refs
(Grant DAHC04-75-G-0016; ARO Proj. 12373-M)
(AD-A017542; ARO-12373.8-M; TR-62) Avail: NTIS CSCL 21/2

The burning of a spherical fuel drop immersed in an oxidizer is considered in the neighborhood of the frozen limit. When the vaporization rate differs from the frozen value of O(theta(-1)), where theta is a measure of the large activation energy, a near frozen description is obtained which includes the ignition point. This uncovers a simple criterion for distinguishing those situations for which autoignition must occur, from those for which the burning rate varies smoothly with pressure. GRA

N76-21306# Cornell Univ., Ithaca, N.Y. Dept. of Theoretical and Applied Mechanics.
MODERATE BURNING OF A LIQUID FUEL DROP
John D. Buckmaster Nov. 1974 30 p refs
(Grant DAHC04-75-G-0016; ARO Proj. 12373-M)
(AD-A017543; ARO-12373.9-M; TR-63) Avail: NTIS CSCL 21/2

The burning of a spherical fuel drop immersed in an oxidizer is considered in the limit of infinite activation energy. For certain values of the various parameters a rational flame-sheet theory is constructed and explicit formulae are deduced for all the quantities that characterize the burning. All the solutions correspond to 'mode-rate burning' for which the vaporization rate is a decreasing function of Damkohler number. Author (GRA)

N76-21307# Cornell Univ., Ithaca, N.Y. Dept. of Theoretical and Applied Mechanics.
STRONG BURNING OF A LIQUID FUEL DROP
John D. Buckmaster Jan. 1975 23 p refs
(Grant DAHC04-75-G-0016; ARO Proj. 12373-M)
(AD-A017544; ARO-12373.10-M; TR-65) Avail: NTIS CSCL 21/2

The combustion of a liquid fuel drop is considered in the neighborhood of the classical large Damkohler number (or Burke-Schumann) limit, when the activation energy theta is also very large. By permitting M, the fuel vaporization rate, to differ from its equilibrium value by O(1/theta), the entire strong-burning branch is described. Analytic criteria are deduced for the solution to be valid, and these permit explicit predictions of when M is a multiple-valued function of the Damkohler number. GRA

N76-21308# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
THE POLAROGRAPHIC DETERMINATION OF HYDRAZINE IN AQUEOUS SOLUTIONS WITH 5-NITROSALICYLALDEHYDE Final Report, Mar. 1974 - Mar. 1975
J. Brennan Gisclard Jun. 1975 18 p refs
(AF Proj. 6302)
(AD-A017662; AFFDL-TR-75-116) Avail: NTIS CSCL 07/3

A simple and fairly rapid polarographic procedure has been developed for the quantitative determination of hydrazine in surface waters. The method uses only one special but commercially available reagent (5-nitrosalicylaldehyde), and the precision and accuracy make it a reliable procedure for the determination of hydrazine in any investigation of this compound in aqueous systems where the concentration may range from 0.25 to 5 mg/1. Concentrations above 5 mg/1 should preferably be diluted before the method is applied. Author (GRA)

N76-21309# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF PRESSURE ON THE EVAPORATION RATE OF LIQUID DROPLETS IN AN AIR FLOW
V. I. Blinov, L. P. Dobrovolskaya, and A. D. Ivanov 19 Nov. 1975 14 p refs Transl. into ENGLISH from Fiz. Aerodispersnykh Sistem (USSR), no. 7, 1972 p 53-58
(AD-A017884; FTD-ID(RS)I-2260-75) Avail: NTIS CSCL 07/4

In this work the author presents the results of an investigation of the evaporation of bromoethane and tetrafluorodibromethane (Freon 114-B-2) droplets in an air flow under pressures from 760 to 200 mm Hg. There is also a description of the set-up that was used in the experiment. GRA

N76-21310# Arizona Univ., Tucson. Dept. of Chemistry.
AN IMPROVED CELL FOR SPECTROELECTROCHEMICAL MEASUREMENTS Interim Report
F. R. Shu and G. S. Wilson 20 Nov. 1975 16 p refs Submitted for publication
(Contract N00014-75-C-0512; NR Proj. 051-518)
(AD-A018032; TR-6) Avail: NTIS CSCL 07/4

A new cell is described which permits the total optical path length to be significantly shortened using a light pipe. The effects of the light pipe on the electrochemical response of the cell are discussed. GRA

N76-21311# Kentucky Univ., Lexington.
GAS ADSORPTION BY ACTIVATED AND IMPREGNATED CARBONS Quarterly Status Report, Apr. - Jul. 1975
P. J. Reucroft and C. T. Chiou Jul. 1975 35 p refs
(Contract DAAA15-74-C-0163; DA Proj. 1W7-62710-A-095)
(AD-A016978; EC-CR-76015; QSR-5) Avail: NTIS CSCL 07/4

In the period reported, equilibrium adsorption isotherms have been measured for chloroform and phosgene on BPL grade activated carbon, ASC whetlerite and four ASB impregnated carbons. The results have been analyzed in terms of the Dubinin-Polanyi isotherm equation. GRA

N76-21312# Stanford Research Inst., Menlo Park, Calif.
OXIDATION OF SULFUR AND AMINE MODEL COMPOUNDS Quarterly Progress Report, Mar. - Jul. 1975
T. Mill and C. W. Gould Aug. 1975 16 p refs
(Contract DAAA15-74-C-0150; DA Proj. 1W7-62710-AD-60)
(AD-A016977; SRI-PYU-3280-4; EC-CR-76017) Avail: NTIS

CSCL 07/3

Very high rates of conversion of Bu2S to Bu2SO are possible (75% conversion in 15 minutes) using sunlight and photosensitizers in solution to give, almost quantitatively, Bu2SO. Somewhat lower rates are obtained using polymer-bound RB but the available evidence points to a longer useful lifetime for P-RB than for RB in solution owing to a much lower rate of bleaching. The intrinsic rate of photooxidation of iPr2NEt by RB and O2 appears to be about one-hundredth as fast as for Bu2S and to proceed by another mechanism. Experiments at 0.78M are in agreement with published data for oxidation of 0.02M Bu3N. GRA

N76-21313# National Bureau of Standards, Washington, D.C. Building Research Div.

FIRE ENDURANCE OF GYPSUM BOARD WALLS AND CHASES CONTAINING PLASTIC AND METALLIC DRAIN, WASTE AND VENT PLUMBING SYSTEMS Final Report

W. J. Parker, M. Paabo, J. T. Scott, D. Gross, and I. A. Benjamin Sep. 1975 116 p refs Sponsored in part by Dept. of Housing and Urban Develop., Washington, D. C.

(PB-247537/4; NBS-BSS-72) Avail: NTIS HC $5.50 CSCL 13L

The use of plastic pipe in plumbing systems of multiple-occupancy buildings has raised considerations regarding fire safety. To provide needed data, ten full-scale fire endurance tests were performed involving a total of 39 plumbing chase and wall assemblies containing plastic and metal drain, waste, and vent (DWV) systems typical of installations serving one or two story buildings. Two tests were conducted using plumbing chase configurations simulating kitchen sink drain systems. Six fire endurance tests were conducted in which the performance of ABS, PVC, copper and iron was compared directly in kitchen sink drain systems as installed in wood-stud and gypsum-board walls. GRA

N76-21314# National Bureau of Standards, Washington, D.C. Center for Fire Research.

SMOKE AND CARBON MONOXIDE FORMATION FROM MATERIALS TESTED IN THE SMOKE DENSITY CHAMBER Final Report

Thomas Y. King (Armstrong Cork Co., Lancaster, Pa.) Oct. 1975 41 p refs

(PB-246860/1; NBSIR-75-901) Avail: NTIS HC $4.00 CSCL 14B

The effects of physical and chemical factors on the smoke and carbon monoxide generated by burning polymers and red oak in the NBS Smoke Density Chamber are reported. Smoke and carbon monoxide formation was found to depend on irradiance level and oxygen concentration in the chamber. Smoke optical density correlations with particulate mass density showed that the ratio of these two varied with material composition and burning conditions. GRA

N76-21315# Exxon Research and Engineering Co., Linden, N.J. Government Research Lab.

SURVEY AND EVALUATION OF KINETIC DATA ON REACTIONS IN METHANE/AIR COMBUSTION Phase Report, Apr. 1973 - May 1975

Victor S. Engleman Jan. 1976 477 p refs

(Contract EPA-68-02-0224)

(PB-248139/8; EPA-600/2-76-003) Avail: NTIS HC $12.50 CSCL 07D

Results are given of a survey and evaluation of kinetic data on the chemical reactions involved in methane/air combustion at 1 atm pressure, 80-125% stoichiometric air, and combustion temperatures between 1,500 and 2,500K. First, a set of species commonly observed or postulated to play a role in methane/air combustion was selected. Next, a computer code was developed, assembling all mathematically possible unimolecular and bimolecular reactions involving those species. The report includes information on the thermochemistry, a literature survey of reported rate data, an evaluation of the importance of each reaction, recommendations of the best rate data from that available in the literature, and rate estimates for potentially important reactions for which no satisfactory rate was found in the literature. GRA

N76-21316# Ballistic Research Labs., Aberdeen Proving Ground, Md.

PARAMETRIC SENSITIVITY STUDY OF A NUMERICAL MODEL FOR FLAME SPREADING Final Report

Clarence W. Kitchens, Jr. Oct. 1975 32 p refs

(DA Proj. 1T1-61102-A-336; DA Proj. 1T1-61102-A-32C)

(AD-A018135; BRL-MR-2546) Avail: NTIS CSCL 21/2

A sensitivity study is performed to identify critical input assumptions in a numerical model for flame spreading. This model is applied to predict flame spreading phenomena in a bed of small arms ball propellant. The numerical results are compared with experimental pressure measurements taken in 5.85 and 10.84 cm long venting chambers. The predicted flame spreading rate is approximately three times slower than is indicated in the experiments. The sensitivity calculations identify the relative importance of assumptions about the average particle size, ignition criteria, drag correlation, heat transfer correlation, compaction distance, porosity distribution, and burning rate. The compaction distance and initial porosity distribution are identified as important parameters in this model. It appears that a two-phase flow model is required for more realistic flame spreading simulations. Author (GRA)

N76-21317# Technology, Inc., Dayton, Ohio.

DESIGN STUDIES ON SIMULATION OF SUPERSONIC MIXING AND COMBUSTION PHENOMENA Final Report, 1 Aug. 1974 - 31 Jul. 1975

Michael E. Neer Jun. 1975 111 p refs

(Contract F33615-75-C-1010; AF Proj. 7065)

(AD-A017856; ARL-TR-75-0225) Avail: NTIS CSCL 21/2

An advanced planning study was performed to improve and better utilize the supersonic combustion research facility of the Air Force Aerospace Research Laboratories. Two computer programs (utilizing a one-dimensional gasdynamic model with pseudo-equilibrium hydrogen-air chemistry) were developed and used in parametric studies to determine the effects of mixing on thermal choking and to analyze combustion chamber design. The operating envelopes for an actual scramjet combustion chamber were determined and compared with the operating envelope of the ARL supersonic combustion facility. GRA

N76-21508* Princeton Univ., N.J.

PHOTOCATALYTIC GENERATION OF HYDROGEN FROM WATER

William R. Bottoms and Richard B. Miles *In* NASA. Ames Res. Center 2d NASA Conf. on Laser Energy Conversion 1976 p 23-37 refs (For availability see N76-21505 12-36)

CSCL 07D

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N76-21318*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INTERIM ANALYSIS OF LONG TIME CREEP BEHAVIOR OF COLUMBIUM C-103 ALLOY

William D. Klopp and Robert H. Titran Mar. 1976 21 p refs (NASA-TM-X-71895; E-8681) Avail: NTIS HC $3.50 CSCL 11F

Analysis of 16 long time creep tests on columbium C-103 alloy (Cb-10Hf-1Ti-0.7Zr) indicates that the calculated stresses to give 1 percent creep strain in 100,000 hours at 1,255 K (1800 F) are 7.93 and 8.96 MPa (1,150 and 1,300 psi) for fine grained and course grained materials, respectively. The apparent activation energy and stress dependence for creep of this alloy are approximately 315 KJ/gmol (75,300 cal/gmol) and 2.51, respectively, based on Dorn-Sherby types of relations. However, the 90 percent confidence limits on these values are wide because of the limited data currently available. Author

N76-21319*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CORRELATIONS AMONG ULTRASONIC PROPAGATION FACTORS AND FRACTURE TOUGHNESS PROPERTIES OF METALLIC MATERIALS

Alex Vary 1976 31 p refs Presented at Spring Conf. of the

Am. Soc. for Nondestructive Testing, Los Angeles, 8-11 Mar. 1976
(NASA-TM-X-71889; E-8671) Avail: NTIS HC $4.00 CSCL 11D

Empirical evidence was developed to show that a close relation exists among fracture toughness, yield strength, and ultrasonic attenuation properties of metallic materials. The evidence was obtained by ultrasonic probing of specimens of two maraging steels and a titanium alloy. It was concluded that nondestructive ultrasonic methods can be used to indirectly evaluate fracture-related material properties. The results suggest that these nondestructive ultrasonic measurements can also serve as an adjunct to destructive testing, measurement, and analysis of fracture properties. Author

N76-21320*# Kanner (Leo) Associates, Redwood City, Calif.
MOESSBAUER EFFECT MEASUREMENTS IN TITANIUM-RICH IRON-TITANIUM SYSTEM
G. Rupp Washington NASA Apr. 1976 17 p refs Transl. into ENGLISH from Z. Physik (Berlin), v. 230, 1970 p 265-277
(NASA-TT-F-16982) Avail: NTIS HC $3.50 CSCL 11F

Using the Mossbauer effect of Fe -57, the magnetic moments of Fe atoms dissolved in Ti were measured. This problem is of interest because the superconducting transition temperature TC increases with Fe concentration. The superconducting high temperature phase beta-Ti-Fe and the other stable and metastable phases were studied up to the intermetallic compound FeTi. It was found that no localized magnetic moment exists with the Fe atoms in any of these phases. The theory of Ganguly et al. for increasing TC is therefore applicable. The only phase showing quadrupole interaction is beta-Ti-Fe; the electric field gradient must be caused by a distortion of the cubic lattice. Two different isomer shifts are found in beta-Ti-Fe which cannot be understood by the phase diagram: one for beta-Ti-Fe with x > or = 8 at. % Fe, the other for < or = 8 at. % Fe. The former is equal to the value of FeTi, the latter to the omega phase. The difference is 0.10 mm/s. Author

N76-21321# National Aerospace Lab., Tokyo (Japan).
RELATION BETWEEN SCATTER OF FATIGUE LIFE AND S-N CURVE OF 2024-T4 AIRCRAFT STRUCTURAL ALUMINUM ALLOY SPECIMENS WITH A CIRCULAR HOLE AT CONSTANT TEMPERATURE AND HUMIDITY
Toshiyuki Shimokawa and Yasumasa Hamaguchi Oct. 1975 12 p refs In JAPANESE; ENGLISH summary
(NAL-TR-431) Avail: NTIS HC $3.50

When a new factor serving as an error in applied stress is added to an identical condition under which an S-N curve has been obtained, it causes a deviation from the fatigue life estimated from the S-N curve, and the amount of the deviation is related to the slope of the S-N curve. The accumulated effect of all factors causing the fatigue life scatter is regarded as an error in applied stress, and is examined. The equivalent stress is defined as the sum of the applied stress and the error in applied stress. This concept was applied to the results of a series of fatigue tests on 2024-T4 aircraft structural aluminum alloy specimens with a circular hole at constant temperature and humidity. The interrelation between the scatter of the equivalent stress, the S-N Curve, where N is the median fatigue life, and the scattering of fatigue life is discussed. The results obtained are compared with those in the case of specimens with a sharp notch in a previous paper. Author

N76-21322*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SELECTED FRETTING-WEAR-RESISTANT COATINGS FOR TITANIUM - 6-PERCENT-ALUMINUM - 4-PERCENT-VANADIUM ALLOY
Robert C. Bill Washington Apr. 1976 24 p refs
(NASA-TN-D-8214; E-8594) Avail: NTIS HC $3.50 CSCL 11F

A titanium - 6-percent-aluminum - 4-percent-vanadium alloy (Ti-6Al-4V) was subjected to fretting-wear exposures against uncoated Ti-6Al-4V as a baseline and against various coatings and surface treatments applied to Ti-6Al-4V. The coatings evaluated included plasma-sprayed tungsten carbide with 12 percent cobalt, aluminum oxide with 13 percent titanium oxide, chromium oxide, and aluminum bronze with 10 percent aromatic polyester; polymer-bonded polyimide, polyimide with graphite fluoride, polyimide with molybdenum disulfide (MoS_2), and methyl phenyl silicone bonded MoS_2, preoxidation surface treatment, a nitride surface treatment, and a sputtered MoS_2 coating. Results of wear measurements on both the coated and uncoated surfaces after 300,000 fretting cycles indicated that the polyimide coating was the most wear resistant and caused the least wear to the uncoated mating surface. Author

N76-21323# Atomic Weapons Research Establishment, Aldermaston (England).
SURVEY OF THE HEAT TREATMENT AND MECHANICAL PROPERTIES OF URANIUM/LOW TITANIUM ALLOYS
G. P. R. McCarthy Aug. 1975 28 p refs
(AWRE-O-16/75) Avail: ERDA Depository Libraries HC $4.50

A survey of the heat treatment and mechanical properties of uranium alloys containing up to 1.6 wt% titanium was made. The amount of information available in the literature is somewhat limited. One trend that was observed was that increasing the titanium content up to 0.8 wt% gave increasing elongation for a given strength level. There was no information on alloys above 0.8 wt% titanium to indicate to what extent this trend continues. Author (NSA)

N76-21324# Maryland Univ., College Park. Engineering Materials Group.
INVESTIGATION OF IRRADIATION STRENGTHENING OF B. C. C. METALS AND THEIR ALLOYS Progress Report, Jan. - Oct. 1975
1975 174 p refs
(Contract AT(40-1)-3612)
(ORO-3612-12) Avail: NTIS HC $11.75

Results of studies on radiation strengthening of V, Mo, and Nb are presented. Information is included on deformation characteristics of low temperature neutron irradiated Nb, the effects of He(3+) on the low temperature deformation characteristics of Nb, electron transmission microscopic studies of the nature of neutron damage effects of post-irradiation annealing, microplasticity, thermally activated dislocation motion, production of high purity Nb and V, early stages of flow in Mo, microplasticity in V, and effects of impurity interstitials on the lattice resistance to dislocation motion. NSA

N76-21325# Oak Ridge National Lab., Tenn.
CONTROLLED THERMONUCLEAR MATERIALS TECHNOLOGY PROGRAM Annual Progress Report, period ending 30 Jun. 1975
J. L. Scott Oct. 1975 87 p refs
(Contract W-7405-eng-26)
(ORNL-5082) Avail: NTIS HC $5.45

Detailed descriptions are given of research progress in the following areas: (1) microstructure of irradiated 316 stainless steel containing high helium concentrations, (2) temperature and fluency limitations for a type 316 stainless steel CTR first wall, (3) swelling and microstructural changes in irradiated vanadium alloys, (4) mechanical properties of irradiated V-20 wt percent Ti, (5) radiation damage calculations, (6) evaluation of irradiation facilities for CTR materials development, (7) surface studies, compatibility studies, (8) magnet development, (9) EPR design support, and (10) the influence of structural materials on fusion-reactor blanket response. NSA

N76-21326# California Univ., Berkeley. Lawrence Berkeley Lab.
AUGER ELECTRON SPECTROSCOPY OF ALLOY SURFACES
S. H. Overbury and G. A. Somorjai Mar. 1975 25 p refs Presented at the Conf. of the Faraday Soc. on Electron Spectroscopy of Solids and Surfaces, Vancouver, Canada, 15 Jul. 1975
(Contract W-7405-eng-48)
(LBL-3742; Conf-750702-1) Avail: NTIS HC $4.25

Regular solution models are used to predict surface segregation of the constituent of lowest surface free energy in homogeneous multicomponent systems. Analysis of the Auger electron emission intensities from alloys yields the surface composition and the depth distribution of the composition near the surface.

Auger electron spectroscopy (AES) studies of the surface composition of the Ag-Au and Pb-In systems have been carried out as a function of bulk composition and temperature. Although these alloys have very different regular solution parameters their surface compositions are predictable by the regular solution models. Author (NSA)

N76-21327# Ames Lab., Iowa.
INFLUENCE OF OXYGEN ON DEFECT CLUSTERS, RADIATION HARDENING, AND RADIATION-ANNEAL HARDENING IN VANADIUM
M. S. Wechsler (Iowa State Univ.) and R. Bajaj (Westinghouse Elec. Corp., Madison, Pa.) 1975 16 p refs Presented at US-Japan Seminar on Radiation-Produced Defects and Defect Clusters and Their Effects in Metals, Ames, Iowa, 28-30 Sep. 1975 Sponsored by ERDA
(IS-M-46; Conf-750952-1) Avail: NTIS HC $4.00

On increasing the oxygen concentration, the defect cluster density in neutron-irradiated vanadium increases, the average size decreases, and the stability against annealing increases. Higher oxygen concentrations in vanadium also have the effect of increasing the radiation hardening and radiation-anneal hardening. Based on a dispersed barrier model embracing defect clusters of all sizes, the radiation-anneal hardening is due principally to a strengthening of the defect clusters as barriers to slip dislocation motion, not to changes in the density and size distribution of the defect clusters. The observations are consistent with the nucleation of defect clusters by small oxygen or oxygen-point defect complexes upon irradiation and the trapping of oxygen at defect clusters upon post-irradiation annealing. NSA

N76-21328# Utah Univ., Salt Lake City. Div. of Materials Science and Engineering.
POSITRON LIFETIME MEASUREMENTS AS A NON-DESTRUCTIVE TECHNIQUE TO MONITOR FATIGUE DAMAGE
J. G. Byrne Sep. 1975 35 p refs
(Contract E(11-1)-2128)
(UTEC-75-130; COO-2128-11) Avail: NTIS HC $4.75

In the fatigue cycling of initially hard copper, self consistent positron lifetime and X-ray particle size measurements followed the softening process and revealed a new feature which may be the final development of microvoids before fracture. In the cyclic fatigue of initially soft 4340 steel closely spaced concurrent measurements of these parameters were taken. For initially hard 4340 steel fatigue softening was revealed with a large positron lifetime decrease. In hydrogen embrittlement studies positron lifetime was found to be sensitive to hydrogen in an interesting way, i.e., if a specimen is already at its maximum defect density, hydrogen is trapped at some of the defects, reduce their attraction for positrons and hence cause a decrease in positron lifetime; conversely in a soft specimen, hydrogen generates more dislocation length than it can trap at (thus cancelling) hence a positron lifetime increase occurs. Author (NSA)

N76-21329# Aktiebolaget Atomenergi, Studsvik (Sweden).
OBSERVATIONS ON DEFORMATION SYSTEMS IN ZIRCALOY-2 DEFORMED AT ROOM TEMPERATURE
K. Pettersson and H. Bergqvist Aug. 1975 21 p refs
(AE-505) Avail: ERDA Depository Libraries HC $4.25

Different polycrystalline samples of Zircaloy-2 with textures such that the c-axis of most of the grains is oriented near the sheet normal were subjected to loading conditions such that sheet thinning was accomplished. Metallography showed that no twinning was involved. Electron microscopy showed the presence of <c+a> dislocations that were usually confined to deformation bands. With the help of stereo micrographs the most likely plane of slip was determined to be /10(-1)1/. The possibility of <c+a> slip as a means of breaking the oxide film in iodine induced stress corrosion cracking of Zircaloy-2 is briefly discussed. Author (NSA)

N76-21330# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material und Festkoerperforschung.
INFLUENCE OF COLD WORK ON STEAM CORROSION (550 DEG, 70 AT) OF FIVE FERRITIC STEELS WITH DIFFERENT CHROMIUM CONTENT
S. Leistikow, A. V. Thenen, and E. Pott Feb. 1975 69 p refs In GERMAN
(KFK-2120) Avail: ERDA Depository Libraries HC $6.50

Five different ferritic chromium steels were tested at 550 C and 70 atm in superheated steam to evaluate steam corrosion dependence on chromium content and the amount of cold work. Oxidation kinetics and oxide morphology were examined by gravimetric, metallographic, and microanalytical methods. The results show that for all alloys > or = 6.7 percent Cr, corrosion resistance increased with increasing cold work. A gain of 70 to 75% was found after a 1000 hours exposure in case of 80% cold deformed alloys containing more than 11% Cr. The relationship between corrosion, chromium content, and cold deformation was approximated by a negative exponential function. Results of microanalysis showed high chromium content in local areas of highly deformed oxidized 18.7% Cr alloy. The effect of the bulk deforming pretreatments on corrosion rate is explained by improved diffusivity of chromium in the defect structure, preferential oxidation, and formation of a solid solution (FeFe (2-x) CrxO4) of spinel type as oxide subscale. Author (NSA)

N76-21331# Oak Ridge National Lab., Tenn.
RELATION BETWEEN THE SHAPE OF HIGH FREQUENCY HEATING COIL AND THE TEMPERATURE DISTRIBUTION IN SPECIMEN DURING THERMAL FATIGUE TEST
Takeshi Maruyama, Seiji Kimura, and Takaharu Kurumaji 1975 11 p refs Transl. into ENGLISH from Zairyo (Kyoto), v. 24, no. 258, 1975 p 185-233 Presented at 12th High Temperature Strength Symp. 8 Oct. 1974
(ORNL-TR-2980) Avail: NTIS HC $4.00

The high frequency heating apparatus used for thermal fatigue tests, the relation between the shape of heating coils, and the temperature distribution of specimens was experimentally examined for SUS 304 stainless steel. Relations between heating coil dimensions and heating rate, the most ideal coil shape for various specimen types, and the effects of temperature range and specimen shape on temperature distribution are described. Results show that the heating rate increases with decreasing distance from specimen surface to heating coil and with increasing coil tube diameter. For the general cylindrical and hour glass type specimens, the most ideal coil shapes are a separate type and a parallel type coil, respectively as judged from the point of temperature distribution. Author (NSA)

N76-21332# British Steel Corp., Sheffield (England). Corporate Development Lab.
AN INVESTIGATION OF THE PROCESSING CHARACTERISTICS AND PROPERTIES OF NIOBIUM BEARING EDD STEELS
R. Gillanders, C. Dasarathy, and R. C. Hudd Oct. 1975 39 p refs
(PB-246883/3; SM/814/A) Avail: NTIS HC $4.00 CSCL 11F

Steels of a vacuum degassed cast were alloyed to give niobium contents of 0.07, 0.12, 0.23 and 0.27 wt%. Hot rolled material was cold reduced and the annealing behavior was investigated. Results show that to increase the niobium content was to increase the recrystallization temperature. Niobium steels recrystallized at higher temperatures than vacuum degassed titanium steels and aluminum killed steels. Steels with deep drawing properties superior to those of conventional CR1 aluminum stabilized steels and comparable with those of vacuum degassed titanium bearing steels may be obtained by niobium additions. The best combination of annealed properties was obtained in a steel containing 0.12% Nb. GRA

N76-21333# British Steel Corp., Sheffield (England). Corporate Development Lab.
BORON IN STEEL
D. Jones Oct. 1975 11 p refs
(PB-246886/6; GS/PROD/717/1/75/C) Avail: NTIS HC $3.50 CSCL 11F

A literature survey into the effects of boron in steels was undertaken. Most of the research work is devoted to improving the hardenability of low carbon, low alloy steels in order to produce air cooled bainitic and martensitic structures. The main effect of boron is to inhibit pro-eutectoid ferrite separation; thus, the maximum hardenability effect is produced in the lower carbon

steels. The retardation of ferrite separation is related to the presence of boron at the prior austenite grain boundaries, and it is well established that there is a critical amount of boron which produces the maximum hardenability. Only soluble boron is effective, thereby making the removal of oxygen and nitrogen, prior to alloying with boron, essential. GRA

N76-21334# Bureau of Mines, Twin Cities, Minn. Mining Research Center.
ELECTROWINNING OF COPPER FROM CHLORIDE SOLUTIONS Report of Investigations, 1975
R. E. Mussler, R. S. Olsen, and T. T. Campbell 1975 27 p refs
(PB-247327/0; BM-RI-8076) Avail: NTIS HC $4.00 CSCL 11F

Electrowinning of copper from chloride solutions was studied in a diaphragm cell. The copper powder product was shaken periodically from the cathode and removed from the bottom of the cell. The effects of copper concentration, brine concentration, copper chloride species, and cell voltage were investigated. Power consumption of 1.1 and 2.1 kW-hr/kg were obtained with cuprous and cupric chloride solutions, respectively. GRA

N76-21335# Nuclear Regulatory Commission, Washington, D.C. Pipe Cracking Study Group.
INVESTIGATION AND EVALUATION OF CRACKING IN AUSTENITIC STAINLESS STEEL PIPING OF BOILING WATER REACTOR PLANTS
Oct. 1975 123 p refs
(PB-246645/6; NUREG-75/067) Avail: NTIS HC $5.50 CSCL 18J

The report covers the investigations of a series of cracks that occurred in the austenitic stainless steel bypass pipes around the discharge valves in the main recirculation loops of six domestic boiling water reactor plants and in the core spray pipes of one boiling water reactor plant. The report describes the recent cracking occurrences as well as similar occurrences in boiling water reactors in the past. The report concludes that the cracks that occurred in six domestic boiling water reactor plant units were the result of intergranular stress corrosion cracking caused by the combination of high residual stresses, light sensitization of the heat affected zones of welds, and the oxygen level normally found in the coolant for this type of reactor. GRA

N76-21336# Rock Island Arsenal Lab., Ill. General Thomas J. Rodman Lab.
THE FORMATION OF REFRACTORY METAL ALLOYS BY SIMULTANEOUS DEPOSITION OF METALS FROM THE GASEOUS PHASE Technical Report, Sep. 1973 - Jun. 1974
Andrew Crowson Jul. 1974 36 p refs
(DA Proj. 1T1-62105-AH-84)
(AD-A018130; RIA-R-TR-74-047) Avail: NTIS CSCL 11/3

Chemical vapor deposition investigations were undertaken to determine the feasibility of coating refractory metals and alloys onto the inside bores of gun barrels. Coatings of tungsten, molybdenum, vanadium, rhenium, and tantalum as well as tungsten alloys were attempted. Process parameters, compositions, and properties of the coatings were determined. Elemental tungsten depositions were initially used to establish the process parameters for subsequent work on tungsten alloy coatings. Ta-10W alloy was plated successfully on the steel substrate at 750 C and 1 atmosphere pressure. The coatings obtained were uniform and adherent. Properties of the alloy coating, Ta-10W, are such that this coating is especially applicable for a high temperature coating for fun barrels. Author (GRA)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N76-21337*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SECOND GENERATION PMR POLYIMIDES
Tito T. Serafini, Raymond D. Vannucci, and William B. Alston 1976 13 p refs Presented at Twenty-first Natl. Symp. and Exhibition of the Soc. for the Advan. of Mater. and Process Eng., Los Angeles, 6-8 Apr. 1976 Prepared in cooperation with Army Air Mobility Res. and Develop. Lab., Cleveland
(NASA-TM-X-71894; E-8680) Avail: NTIS CSCL 11D

Studies were conducted to develop PMR (polymerization of monomer reactants) polyimides with improved thermo-oxidative stability at 600 F. Composites were fabricated using Hercules HTS graphite fiber and the newly developed PMR polyimides. The mechanical property retention characteristics of the composites at 600 F are described. Author.

N76-21338# Institut fuer Festkoerpermechanik, Freiburg (West Germany).
AN EXPERIMENTAL INVESTIGATION INTO CRACK PROPAGATION IN PLATE GLASS AT CRACK SPEEDS BETWEEN 0.001 AND 5000 mm/s
H. Richter Dec. 1974 86 p refs In GERMAN; ENGLISH summary
(IFKM-WB-9/74) Avail: NTIS HC $5.00

In order to investigate crack propagation in single-edge notched specimens, a new opto-electronic method of measuring crack speeds was developed. The work was aimed at determining the origin of fracture surface markings characteristic of the transition region of crack speed, and investigating a nonmonotonic relationship between crack speed and strain energy release rate at relative humidities below 10 %, as well as determining semi-experimentally the geometrical correction to the stress intensity factor using fracture tests at controlled, constant crack speeds. Author (ESA)

N76-21339# Institut fuer Festkoerpermechanik, Freiburg (West Germany).
THE EFFECT OF ULTRASONIC WAVES ON THE FRACTURE PROPERTIES OF KCl SINGLE CRYSTALS
Martin G. Schinker Jul. 1975 173 p refs In GERMAN; ENGLISH summary
(IFKM-WB-1/75) Avail: NTIS HC $6.75

Fracture experiments were performed on single crystal specimens of KCl using longitudinal and transverse ultrasonic waves at frequencies up to 50 MHz. Essentially three different sorts of effect on the fracture process could be observed on KCl fracture surfaces. Using ultrasonic fractography the maximum fracture velocity on KCl cleavage planes was determined for different crack propagation directions. This maximum fracture velocity was found to be independent of crystallographic direction within the limits of accuracy of measurements and had a value of 1040 m/s. Using double cantilever beam specimens of KCl it could be demonstrated that, contrary to previous assumptions, the experimentally determined critical strain energy release rate, G0, was not identical to twice the surface free energy. Taking the elastic anisotropy into account, and using very large KCl specimens to minimize plastic deformation in the arms of the specimens, values of G0 were obtained which were independent of direction within a given cleavage plane and approximately ten times larger than the specific surface free energy. Author (ESA)

N76-21340# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
SYNTHESIS OF OXYARYLENE BBB POLYMER Final Report, Mar. - Dec. 1973
Fred E. Arnold Jun. 1975 24 p refs
(AF Proj. 7340)
(AD-A016475; AFML-TR-74-279) Avail: NTIS CSCL 07/3

This work was performed to determine the extent to which processability parameters such as solubility and fusibility could synthetically be altered in the benzimidazobenzophenanthroline (BBB) polymer system. The BBB polymer has excellent thermal and thermal oxidative properties; however, the polymer is infusible and is only soluble in highly corrosive solvents. A series of BBB polymers had been synthesized. The resulting BBB type polymers with an increased number of rotational sites along the polymer backbone were soluble in m-cresol and exhibited glass transition temperatures in the 300-350C range. All of the polymers displayed good thermal and thermal oxidative stabilities characteristics of this class of materials. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N76-21341*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SYNTHESIS AND ANALYSIS OF JET FUELS FROM SHALE OIL AND COAL SYNCRUDES

Albert C. Antoine and James P. Gallagher (Atlantic Richfield Co.) 1976 32 p refs To be presented at the 82d Natl. Meeting of the Am. Inst. of Chem. Engr., Atlantic City, 29 Aug. - 1 Sep. 1976

(NASA-TM-X-73399; E-8722) Avail: NTIS HC $4.00 CSCL 21D

The technical problems involved in converting a significant portion of a barrel of either a shale oil or coal syncrude into a suitable aviation turbine fuel were studied. TOSCO shale oil, H-Coal and COED coal syncrudes were the starting materials. They were processed by distillation and hydrocracking to produce two levels of yield (20 and 40 weight percent) of material having a distillation range of approximately 422 to 561 K (300 F to 550 F). The full distillation range 311 to 616 K (100 F to 650 F) materials were hydrotreated to meet two sets of specifications (20 and 40 volume percent aromatics, 13.5 and 12.75 weight percent H, 0.2 and 0.5 weight percent S, and 0.1 and 0.2 weight percent N). The hydrotreated materials were distilled to meet given end point and volatility requirements. The syntheses were carried out in laboratory and pilot plant equipment scaled to produce thirty-two 0.0757 cu m (2-gal) samples of jet fuel of varying defined specifications. Detailed analyses for physical and chemical properties were made on the crude starting materials and on the products. Author

N76-21342# Instituto de Investigaciones Cientificas y Tecnicas de las Fuerzas Armadas (CITEFA), Buenos Aires (Argentina).

REVIEW OF SURFACE TEMPERATURE MEASURING METHODS BY RADIATION. APPLICATION TO SOLID PROPELLANTS

Beatriz BanaDeSchor and Jorge E. Toni Nov. 1975 20 p refs In SPANISH; ENGLISH summary

Avail: NTIS HC $3.50

The fundamentals of optical methods for surface temperature measurements are discussed and compared with conventional techniques such as thermocouples. The discussion is oriented to the application of surface temperature determination on solid propellants during the ignition delay or combustion period. Author

N76-21343# Instituto de Investigaciones Cientificas y Tecnicas de las Fuerzas Armadas (CITEFA), Buenos Aires (Argentina).

METHODS OF EMISSIVITY DETERMINATION. APPLICATION TO SOLID PROPELLANTS

Beatriz BanaDeSchor and Jorge E. Toni Nov. 1975 21 p refs In SPANISH; ENGLISH summary

Avail: NTIS HC $3.50

Radiometric and calorimetric methods were described and discussed with special emphasis on differential scanning calorimetry (DSC). The experimental determination of emissivities for a wide range of composite and double base propellants was also covered, applying one of the DSC methods. Author

N76-21344# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Propulsion Directorate.

DEVELOPMENT AND DEMONSTRATION OF A CAST PROPELLANT FOR THE LANCE IGNITER GRAIN

Henry Allen and Marjorie T. Cucksee 10 Sep. 1975 42 p

(AD-A017854; RK-76-6) Avail: NTIS CSCL 16/4

A cast composite propellant based on a HTPB binder was developed to meet the ballistic and physical requirements of the LANCE igniter grain. Formulation parameters were correlated with propellant burn rate and mechanical properties, and 1-gallon mixes were made to provide grains for a feasibility demonstration. The propellant was scaled up to a 20-gallon mixer, and grains were prepared for a prequalification demonstration task. Propellant performance in the 26-shot demonstration firing series was completely successful. The propellant is considered to be ready for qualification in the LANCE igniter. GRA

N76-21345# Army Materiel Command, Alexandria, Va.

ENGINEERING DESIGN HANDBOOK, PROPELLANT ACTUATED DEVICES

Sep. 1975 197 p refs

(AD-A016716; AMCP-706-270) Avail: NTIS CSCL 19/1

The handbook is a revision of the existing handbook published in 1963. The revision updates the material and design methodology, and introduces the application of computer techniques. Also, the revision reorganizes the material and presents the design information in a more logical sequence. The handbook is a guide to design engineers engaged in the development of propellant actuated thrust devices and gas generators for various applications. Topics discussed include the following: Description of propellant actuated devices; Basic design considerations; Preliminary design techniques; Interior ballistic analysis; Design examples; Performance evaluation; Conversion of distortion energy equation to more useful forms for propellant actuated devices; Table of wall ratios; Derivation of equation used in determining length of engagement threads; Computer program for simulation of direct stroking device; Computer program for high-low stroking device; Computer program for high-low grain design. GRA

N76-21346# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE CALCULATION OF EXTENDED CYLINDRICAL EJECTION CHARGE

A. A. Vovk, V. I. Lavrik, and I. A. Luchko 12 Nov. 1975 10 p refs Transl. into ENGLISH from Akad. Nauk, Kiev. Dopovidi. Ser. A Fiz.-Technichni ta Matematichni Nauki (USSR), no. 10, 1972 p 947-950

(AD-A017882; FTD-ID(RS)I-2159-75) Avail: NTIS CSCL 19/4

The behavior of the ground after explosions is considered. Response to deep extended cylindrical ejection charges is calculated in an impulse representation by the conformal mapping method. Constraints which are taken into account in the method of conditioned ejection cylinders or in the method of shape-of-charge variation are eliminated. J.M.S.

N76-21347# Ballistic Research Labs., Aberdeen Proving Ground, Md.

KINETICS OF THE OXIDATION OF HYDRAZINE BY HYDROGEN PEROXIDE, CATALYZED BY COPPER (2) Memorandum Report

Carl R. Wellman, J. Richard Ward, and Lester P. Kuhn Aug. 1975 21 p refs

(DA Proj. 1T0-61101-A-91A)

(AD-A016905; BRL-MR-2523) Avail: NTIS CSCL 07/4

Hydrazine is oxidized by hydrogen peroxide in the presence of copper(II) to form nitrogen and water. The rate of reaction between stoichiometric amounts of hydrazine and hydrogen peroxide in the presence of copper(II) was followed by monitoring the rate of evolved nitrogen. The rate was first order with respect to concentrations of hydrogen peroxide and copper(II), but was independent of the concentration of hydrazine. The most likely mechanism involves formation of a copper(II) - hydrazine complex that reacts with the hydrogen peroxide. The enthalpy of activation and entropy of activation were found. GRA

N76-21348# Princeton Univ., N.J.

IGNITION TRANSIENTS AND PRESSURIZATION IN CLOSED CHAMBERS Technical Report, 1 Dec. 1973 - 30 Nov. 1974

Leonard H. Caveny, Martin Summerfield, and Carl W. Nelson (Ballistic Res. Labs.) Nov. 1975 37 p refs

(Contract DAAD05-72-C-0135)

(AD-A017747; BRL-MR-2558) Avail: NTIS CSCL 19/1

Pressure versus time data obtained from igniting and burning propellants in highly loaded closed chambers (loading densities between 0.1 and 0.3 g/cc) are being used to evaluate propellants in empirical quality and production control procedures. Interpreta-

tions obtained from such production control devices are hampered by uncertainties concerning ignition delays, dynamic burning, heat loss, propellant surface area versus distance burned, and real gas effects. In this study, attention is focused on devising a closed chamber experiment for measuring dynamic burning rates and on developing a comprehensive analytical model of the experiment. Features of the model include the energy equation, heat-up to ignition, generalized real gas effects, and dynamic burning. Calculated results lead to improved methods for analyzing and reporting closed chamber results so as to include information on the dynamic processes that dominate ignition and the early stages of pressurization. GRA

N76-21349# Naval Surface Weapons Center, White Oak, Md.
EXPLOSIBILITY OF PRESSURIZED HELIUM-ACETLYENE MIXTURES Technical Report, Mar. 1974 - Apr. 1975
Joseph G. Connor, Jr. 6 Oct. 1975 46 p refs
(AD-A018014; NSWC/WOL/TR-75-131) Avail: NTIS CSCL 19/1

The helium volume concentrations in acetylene necessary to prevent explosive type reactions have been established for total pressures between 10 and 2000 psig. Reaction vessels of two sizes were used with thermal ignition by both hot wires and squibs. At 2000 psig total pressure a safe mixture of helium and acetylene requires a minimum of 90% helium by volume. At 1000 psig the helium concentration should be at least 85%, at 500 psig - 82%, and at 200 psig - 73%. Author (GRA)

N76-21350# Delaware Univ., Newark. Chemistry Dept.
LATTICE DYNAMICS IN AMMONIUM PERCHLORATE Annual Report
Thomas B. Brill 20 Oct. 1975 33 p refs
(Grant AF-AFOSR-2131-71; AF Proj. 9711)
(AD-A017678; AFOSR-75-1546TR) Avail: NTIS CSCL 07/2

The breakdown of the crystal lattice of ammonium perchlorate in the 300-625 K range has been studied by laser Raman spectroscopy. Detailed examination of the external and internal modes of the ion reveals that the onset of essentially unhindered tumbling of the ClO4(-) ion seems to be intimately tied to the decomposition of AP. The effect of K(+) as an isomorphous dopant in the crystal lattice is to permit the ClO4(-) ion to tumble at a lower temperature (0.8% K(+) produces a 60-70 K lowering in the tumbling temperature) and thus decompose at a lower temperature. Pressure effects on AP at 300 K show normal behavior and we do not believe that pressure plays a very large role in the decomposition of the crystal. All vibrational modes found in ammonium perchlorate including several not here-to-fore reported are discussed and insofar as possible assigned. GRA

N76-21351# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
SOLID PROPELLANT ADMITTANCE MEASUREMENTS BY THE DRIVEN TUBE METHOD Interim Scientific Report, Jun. 1974 - Jul. 1975
B. T. Zinn, B. R. Daniel, W. A. Bell, and M. Salikuddin Arlington, Va. AFOSR Aug. 1975 74 p refs
(Grant AF-AFOSR-2571-73; AF Proj. 9711)-
(AD-A017656; AFOSR-75-1531TR) Avail: NTIS CSCL 21/9

Progress made during the second year of an investigation on the application of the impedance tube technique in the measurement of the response function of a burning solid propellant, subjected to oscillating flow conditions, is described in this report. Modifications to the originally proposed measurement technique are outlined and the admittances of a number of different solid propellants measured at low pressures and over frequency ranges of interest in solid propellant instability are presented. Also discussed in this report are the results of analytical studies concerned with (1) determination of the behavior of a standing wave in a tube containing a steady flow and a steady temperature gradient; (2) the dependence of the standing wave structure upon the boundary condition at the propellant surface and the characteristics of the steady axial temperature profile in the burner tube; (3) the use of acoustic pressure data in the determination of the propellant response factor; and (4) the development of a non-linear regression technique for the improvement of the accuracy of the measured propellant response factor. Finally, the measured low pressure propellant response factor data is analyzed and its possible dependence upon particle gas phase attenuation and the propellant 'self-driving' is discussed.
Author (GRA)

N76-21352# Hercules, Inc., Magna, Utah. Bacchus Works.
ICBM OVERTEST TECHNOLOGY, VOLUME 1 Final Report
A. S. Daniels, S. C. Browning, K. D. Smartt, and T. D. Pavelka Oct. 1975 255 p refs 2 Vol.
(Contract F04611-73-c-0010; AF Proj. 3059)
(AD-A017753; AFRPL-TR-75-51-Vol-1) Avail: NTIS CSCL 16/4

This is the final report on the ICBM Overtest Technology Program which was performed by Hercules Incorporated for the Air Force. The primary objective of the program was to develop overtest technology for the prediction of ICBM motor service life. An important secondary objective was to make predictions of the M57A1 motor life. The most critical failure modes were shown by analysis and verified by analog subscale and full-scale motor tests to be wing slot cracking and aft centerport debonding in response to the ignition transient. Event gages were developed for detecting time of failure and to verify gage response. Since no aging effects on the grain were determined, an indefinite service life was projected for the Minuteman 2 Stage 3 motor. A manual of recommended practice for incorporating overtest concepts in surveillance programs has been prepared. GRA

N76-21353# Hercules, Inc., Magna, Utah. Bacchus Works.
ICBM OVERTEST TECHNOLOGY, VOLUME 2 Final Report
A. S. Daniels, S. C. Browning, K. D. Smartt, and T. D. Pavelka Oct. 1975 94 p refs
(Contract F04611-73-C-0010; AF Proj. 3059)
(AD-A017754; AFRPL-TR-75-51-Vol-2) Avail: NTIS CSCL 16/4

This is the final report on the ICBM Overtest Technology Program which was performed by Hercules Incorporated for the Air Force. The primary objective of the program was to develop overtest technology for the prediction of ICBM motor service life. An important secondary objective was to make predictions of the M57A1 motor life. Volume 2 contains part VI and appendices A and B. GRA

N76-21354# Edgewood Arsenal, Aberdeen Proving Ground, Md.
DEVELOPMENT OF RAPID-BURNING INCAPACITATING PYROTECHNIC MIXTURES
Cecil Massell Sep. 1975 25 p refs
(AD-A017959; ED-TR-75040) Avail: NTIS CSCL 21/2

The object of the study was to develop a rapid-burning incapacitating pyrotechnic mixture that would satisfy a 5- to 10-second emission time requirement. The results of the study are the following: (1) A fast-burning incapacitating pyrotechnic mixture was devised which, when loaded into the 73-cc volume wedge-shaped submunition, satisfies the 5- to 10-second emission time requirement. The mixture must be granulated to an average particle size of 2,500 micrometers and pressed at 1610 kg/sq cm.; (2) The burning rate is a function of stoichiometry, loading pressure, and particle size; (3) The mixture has a vaporization efficiency of 70%. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N76-21355# Brookhaven National Lab., Upton, N.Y.
ADVANCED REFRIGERATION SYSTEM FOR THE BROOKHAVEN SUPERCONDUCTING CABLE PROJECT
J. E. Jensen 1975 42 p refs Presented at Symp. on Advan. Refrig. Systems, Moscow, Sep. 1975 Sponsored by ERDA and NSF
(BNL-20443; Conf-750956-1) Avail: NTIS HC $5.25

A description is given of a basic supercritical refrigerator. The present status of the cable enclosure and the types of cooling schemes being considered are presented with some examples of laboratory results and computer analysis. NSA

N76-21356# California Univ., Berkeley. Fire Research Group.
DESIGN OF A FIRE PROOF VEHICLE

Calvin Chan Jul. 1975 80 p Sponsored by NSF
(PB-246740/5; UCB-FRG-75-18; NSF/RA/T-75-032) Avail: NTIS HC $5.00 CSCL 13F

A Chevrolet Vega Notchback was modified to insure maximum fire safety for passengers. Various fire safety devices were added. The gas tank was moved into the trunk to avoid direct hitting due to rear-end collision. The shape of the gas tank was changed to allow finite volume change and avoid spilling of gasoline. The fuel line and the filler tube were redesigned to withstand higher pressure. A honeycombed energy absorption system was installed in the rear bumper to absorb most of the impact energy due to a moderate speed collision. An integrated circuit control system which could detect fire and activate an extinguishant system was added. Experiments were performed only on individual parts, and the results appeared satisfactory. GRA

N76-21357# Army Materiel Command, Alexandria, Va.
ENGINEERING DESIGN HANDBOOK: ENVIRONMENTAL SERIES. PART 5: GLOSSARY OF ENVIRONMENTAL TERMS
31 Jul. 1975 205 p refs
(AD-A015180; AMCP-706-119) Avail: NTIS CSCL 05/2

The glossary is supplied for use with the Environmental Series of Engineering Design Handbooks. Its purpose is to provide definitions of the words and terms used in these handbooks as well as some other closely related words or terms that may be unfamiliar to the average reader. Environmental terms comprise a majority of the contents of this glossary but, since the handbooks also include the effects of environment on materiel and operations, a variety of terms from the related scientific and engineering disciplines are defined. In addition, selected terms unique to military operations are included. Specifically excluded are definitions of both technical and nontechnical terms that are part of the common lexicon and for which the common definition applies as used in the handbooks. In many cases, only the appropriate uncommon definition of a term is provided. Cross-referencing is employed for definitions common to several terms or that are closely interrelated. Abbreviations and acronyms that are employed in the Environmental Series and that may be unfamiliar to some readers are included. GRA

N76-21358# Ultrasystems, Inc., Phoenix, Ariz. Dynamic Science Div.
ANTHROPOMORPHIC DUMMY POSITIONING, REPEATABILITY, AND STABILITY TESTS Final Report, Dec. 1974 - Mar. 1975
C. Bonelli and E. Enserink Oct. 1975 125 p
(Contract DOT-HS-046-5-1030)
(PB-247058/1; Dyn-Sci-6510-75-98; DOT-HS-801754) Avail: NTIS HC $5.50 CSCL 13F

The Part 572 anthropomorphic dummy is used to evaluate the performance to automobile passive restraint systems. Dummy position at the time of vehicle-barrier impact is regarded as a significant variable in the evaluation of the restraint system. Effort in this program therefore was directed toward evaluating two dummy positioning procedures as to repeatability of placement in the vehicle and as to the stability during vehicle motion prior to barrier impact. GRA

N76-21359# Toups Corp., Santa Ana, Calif.
PIPELINE INDUSTRY'S PRACTICES USING PLASTIC PIPE IN GAS PIPELINE FACILITIES AND THE RESULTING SAFETY FACTORS Final Technical Report
Jack W. Pierce and Michael B. Steffora Jul. 1975 436 p refs Prepared in cooperation with Extrusion Control Technol., Santa Barbara, Calif.
(Contract DOT-OS-40164)
(PB-247301/5; DOT/OPS-75/07) Avail: NTIS HC $11.75 CSCL 13K

The report summarizes the results of a literature and questionnaire response evaluation related to the performance of plastic pipe in gas, water, and sewer systems; emphasis is on gas distribution. The areas covered indicate use, criteria for selection, quality control, physical properties, construction practices, and maintenance and operating practices. A complete listing of references and a summary of individual state regulatory commission's requirements are also included. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N76-21360 British Broadcasting Corp., Kingswood (England). Engineering Div.
SATELLITE BROADCASTING: THE FEASIBILITY OF ADDING A PSK SUBCARRIER SOUND SIGNAL TO A FM TELEVISION SIGNAL
N. H. C. Gilchrist Feb. 1976 7 p refs
(BBC-RD-1976/8) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Experimental work is described which was carried out to determine whether a four-phase, phase-shift keyed (p.s.k.) sound subcarrier signal could be added to the baseband of a frequency-modulated (FM) television signal of the type currently proposed in Europe for satellite broadcasting, either instead of, or in addition to, the recommended FM sound subcarrier signal. It was found that while a four-phase p.s.k. sound signal could replace the FM sound subcarrier signal, it could not be used additionally without visible disturbance to the picture. Although p.s.k. would have the advantage of enabling two independent high-quality sound programmes to be radiated, the removal of the FM signal would mean a loss of any compatibility with receiver sound demodulation circuits used for reception in normal television broadcasting. Author

N76-21361 British Broadcasting Corp., Kingswood (England). Engineering Div.
REDUCTION OF MUSH-AREA DISTORTION IN COMMON-FREQUENCY mf TRANSMITTER NETWORKS
D. J. Whythe Feb. 1976 13 p refs
(BBC-RD-1976/5) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The present crowding of the medium wave band has made it necessary for several transmitters that broadcast a common program to share a common carrier frequency and in many cases, their service areas considerably overlap. Daytime reception is impaired by ground wave interference between pairs of such transmitters in regions (so-called 'mush' areas where their field strength ratio is less than about 10 db. At night, mutual interference is also caused by sky wave signals from other transmitters in the group. The results of laboratory tests are given which assess the improvement to daytime reception that would result if the times of arrival of the two modulations were equated in these mush areas. The results of a subsequent nine-months field trial between two high power m.f. stations are also described. Test results show the arrangement to be practicable, have stable maintenance, and no need for adjustment. As a result of these properties a substantial improvement was made in daytime reception throughout the test period. Author

N76-21362 British Broadcasting Corp., Kingswood (England). Engineering Div.
DIVERSITY RECEPTION AT HIGH-FREQUENCIES USING THE SINGLE-SIDEBAND MODE
D. E. Susans Feb. 1976 12 p refs
(BBC-RD-1976/6) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

When using long-distance high frequency single-sideband re-broadcast links it is customary to use dual-diversity reception. This method of reception has considerable advantages over a single-channel under conditions of 'flat' fading but it has been reported that any improvement is only marginal when the fading is predominantly frequency-selective. The reasons for this are discussed and a new correlation method of combining the audio outputs of a diversity receiver is suggested. Subjective tests on an experimental correlation combiner have demonstrated improved reception quality. Author

N76-21363 British Broadcasting Corp., Kingswood (England). Engineering Div.
AN EXPERIMENTAL DIGITAL TELEVISION RECORDER

F. A. Bellis Feb. 1976 10 p refs
(BBC-RD-1976/7) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A sub-Nyquist sampling system at twice color sub-carrier frequency is used. The method of operation of the machine is given with particular reference to means whereby errors caused by tape dropouts may be concealed or corrected. The performance of the machine is described, and suggestions are made as to possible uses for the machine as a research tool. Author

N76-21364 British Broadcasting Corp., Kingswood (England). Engineering Div.
LF AND MF PROPAGATION: THE EFFECT OF EARTH CURVATURE ON SEA GAIN
P. Knight Jan. 1976 10 p refs
(BBC-RD-1976/3) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

If a low frequency (LF) or medium frequency (MF) aerial is situated near the sea, the strength of sky-wave signals is increased by sea gain. It is shown that earth curvature has a significant effect at LF and MF on sea gain at coastal sites but has less influence on the reduction of sea gain which occurs when an aerial moves inland or when the sea is of limited extent. Author

N76-21365* National Aeronautics and Space Administration. Pasadena Office, Calif.
HIGHLY EFFICIENT ANTENNA SYSTEM USING A CORRUGATED HORN AND SCANNING HYPERBOLIC REFLECTOR Patent
Kenneth A. Green, inventor (to NASA) (Microwave Res. Corp.) Issued 6 Apr. 1976 8 p Filed 19 Dec. 1974 Supersedes N75-14964 (13 - 06, p 0649) Sponsored by NASA
(NASA-Case-NPO-13568-1; US-Patent-3,949,404; US-Patent-Appl-SN-534265; US-Patent-Class-343-761; US-Patent-Class-343-781; US-Patent-Class-343-786) Avail: US Patent Office CSCL 17B

In a horn-reflector antenna system for producing a spherical aperture phase front, a corrugated conical horn illuminates a section of a hyperbolic reflector to produce a spherical aperture phase front. This front produces a far field beam with low sidelobes and high beam efficiency. The system is insensitive to frequency and polarization changes, and is also insensitive to orientation about the axis of the conical horn for beam scanning. Official Gazette of the U.S. Patent Office

N76-21366* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FILTERING DEVICE Patent
Thomas R. Edwards and Hugh W. Zeanah, inventors (to NASA) Issued 6 Apr. 1976 4 p Filed 17 Dec. 1974 Supersedes N75-14011 (13 - 05, p 0523)
(NASA-Case-MFS-22729-1; US-Patent-3,949,206; US-Patent-Appl-SN-533608; US-Patent-Class-235-156; US-Patent-Class-325-42; US-Patent-Class-333-18) Avail: US Patent Office CSCL 17B

An electrical filter for removing noise from a voice communications signal is reported; seven sample values of the signal are obtained continuously, updated and subjected to filtering. Filtering is accomplished by adding balanced, with respect to a mid-point sample, spaced pairs of the sampled values, and then multiplying each pair by a selected filter constant. The signal products thus obtained are summed to provide a filtered version of the original signal. Official Gazette of the U.S. Patent Office

N76-21367*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A GLOBAL SEARCH AND RESCUE CONCEPT USING SYNTHETIC APERTURE RADAR AND PASSIVE USER TARGETS
W. E. Sivertson, Jr. Washington Apr. 1976 31 p refs
(NASA-TN-D-8172; L-10259) Avail: NTIS HC $4.00 CSCL 17I

A terrestrial search and rescue concept is defined embodying the use of passive radio-frequency reflectors in conjunction with an orbiting synthetic aperture radar to detect, identify, and locate users. An airborne radar test was conducted to evaluate the basic concept. In this test simple corner-reflector targets were successfully imaged. Results from this investigation were positive and indicate that the concept can be used to investigate new approaches focused on the development of a global search and rescue system. Author

N76-21368*# RCA Corp., Princeton, N.J. Astro-Electronics Div.
PAYLOAD OPERATION TELEVISION SYSTEM Final Report
Feb. 1976 79 p
(Contract NAS9-14617)
(NASA-CR-147534) Avail: NTIS HC $5.00 CSCL 17B

The TV system assembled is intended for laboratory experimentation which would develop operational techniques and lead to the design of space-borne TV equipment whose purpose would be to assist the astronaut-operator aboard a space station to load payload components. The TV system assembled for this program is a black and white, monocular, high performance system. The equipment consists principally of a good quality TV camera capable of high resolving power; a TV monitor; a sync generator for driving camera and monitor; and two pan/tilt units which are remotely controlled by the operator. One pan/tilt unit provides control of the pointing of the camera, the other similarly controls the position of a simulated payload. Author

N76-21369*# TRW Systems Group, Redondo Beach, Calif.
RADAR RANGE DATA SIGNAL ENHANCEMENT TRACKER Final Report
23 Apr. 1975 123 p refs
(Contract NAS9-13739)
(NASA-CR-147537; Rept-25533-H013-R0-00) Avail: NTIS HC $5.50 CSCL 17I

The design, fabrication, and performance characteristics are described of two digital data signal enhancement filters which are capable of being inserted between the Space Shuttle Navigation Sensor outputs and the guidance computer. Commonality of interfaces has been stressed so that the filters may be evaluated through operation with simulated sensors or with actual prototype sensor hardware. The filters will provide both a smoothed range and range rate output. Different conceptual approaches are utilized for each filter. The first filter is based on a combination low pass nonrecursive filter and a cascaded simple average smoother for range and range rate, respectively. Filter number two is a tracking filter which is capable of following transient data of the type encountered during burn periods. A test simulator was also designed which generates typical shuttle navigation sensor data. Author

N76-21370# Communications Research Centre, Ottawa (Ontario). Dept. of Communications.
A VHF SPECTRUM OCCUPANCY PILOT PROJECT
W. R. Lauber and W. E. Macklon Jan. 1976 82 p refs
(CRC-1289) Avail: NTIS HC $5.00

A project to monitor, automatically, the signal levels of 10 channels in the 150-175 MHz land mobile service band for 24 hours a day 5 days a week is described. Equipment was assembled and operated to gain experience which would assist in specifying a future operational system, and from this experience, channel usage statistics were calculated for each channel for each hour of the day during April and May 1972. The results show that, for a 6 hour busy-period between 1,000-1,600 hours, 5 minutes per hour is sufficient monitoring time for a reasonalbe estimate of each hour's operation, and a sampling rate of at least one sample per second per channel is necessary to ensure the interception of the shortest transmission. Author

N76-21371*# Pennsylvania State Univ., University Park. Noise Control Lab.
THE PROPAGATION AND ATTENUATION OF COMPLEX ACOUSTIC WAVES IN TREATED CIRCULAR AND ANNULAR DUCTS Final Report, 5 Dec. 1974 - 29 Feb. 1976
Gerhard Reethof 12 Apr. 1976 18 p refs
(Grant NsG-1126)
(NASA-CR-146814) Avail: NTIS HC $3.50 CSCL 20N

The propagation of plane waves and higher order acoustic modes in a circular multisectioned duct was studied. A unique source array consisting of two concentric rings of sources, providing phase and amplitude control in the radial, as well as circumferential direction, was developed to generate plane waves

and both spinning and nonspinning higher order modes. Measurements of attenuation and radial mode shapes were taken with finite length liners between the hard wall sections of an anechoically terminated duct. Materials tested as liners included a glass fiber material and both sintered fiber metals and perforated sheet metals with a honeycomb backing. The fundamental acoustic properties of these materials were studied with emphasis on the attenuation of sound by the liners and the determination of local versus extended reaction behavior for the boundary condition. The experimental results were compared with a mathematical model for the multisectioned duct. Author

N76-21372*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
COMPARISON OF RATE ONE-HALF, EQUIVALENT CONSTRAINT LENGTH 24, BINARY CONVOLUTIONAL CODES FOR USE WITH SEQUENTIAL DECODING ON THE DEEP-SPACE CHANNEL
James L. Massey 9 Apr. 1976 41 p refs
(Grant NsG-5052)
(NASA-CR-146846; EE-762) Avail: NTIS HC $4.00 CSCL 17B

Virtually all previously-suggested rate 1/2 binary convolutional codes with KE = 24 are compared. Their distance properties are given; and their performance, both in computation and in error probability, with sequential decoding on the deep-space channel is determined by simulation. Recommendations are made both for the choice of a specific KE = 24 code as well as for codes to be included in future coding standards for the deep-space channel. A new result given in this report is a method for determining the statistical significance of error probability data when the error probability is so small that it is not feasible to perform enough decoding simulations to obtain more than a very small number of decoding errors. Author

N76-21373# Transportation Systems Center, Cambridge, Mass.
PERFORMANCE EVALUATION OF DATA MODEMS FOR THE AERONAUTICAL SATELLITE CHANNEL Interim Report, Aug. 1974 - Jun. 1975
C. B. Duncombe and H. Salwen (Proteon Associates, Inc.) Sep. 1975 41 p refs
(AD-A017085; DOT-TSC-FAA-75-13; FAA-RD-75-150) Avail: NTIS HC $4.00 CSCL 17/2

The modems tested included a high performance DPSK modem, a high performance CPSK modem, two hybrid voice/data modems, and a lower performance CPSK modem. Data performance results are presented in the form of probability of bit error versus signal to noise density and signal to multipath ratios with Doppler spread as a parameter. Some tests were conducted with a hard limiting IF processor in cascade with the channel simulator to simulate satellite characteristics. The characteristics of the aeronautical satellite channel simulator are also described. Author

N76-21374# Georgia Inst. of Tech., Atlanta.
FAA LIGHTNING PROTECTION STUDY: LIGHTNING PROTECTION REQUIREMENTS FOR AIRPORT SURVEILLANCE RADAR MODEL ASR-7 Final Report, 1 Jan. - 30 Jun. 1975
Gene K. Huddleston and Gary G. Bush Jul. 1975 115 p refs (Contract DOT-FA72WAI-356)
(AD-A019965; FAA-RD-75-180) Avail: NTIS HC $6.75 CSCL 17/9

The protection situations and requirements for the landlines of the ASR-7 radar in regard to lightning- and EMP-induced surges are presented. Gasfilled surge arrestors supplemented with avalanche diode transient suppressors with associated series line resistances are recommended to protect susceptible circuits connected to the buried landlines. Author

N76-21375# Federal Communications Commission, Washington, D.C. Research and Standards Div.
A COMPARATIVE STUDY OF MEDIUM FREQUENCY SKY WAVE FIELD STRENGTH PREDICTION METHODS
John C. H. Wang Aug. 1975 30 p refs
(PB-245564/0; FCC/OCE/RS75-07) Avail: NTIS HC $4.00 CSCL 17B

FCC Rules and Regulations were derived from measurements taken in 1944, a year of low sunspot number. These measurements were extended and the compilation of the results of 26 propagation paths, covering in most cases an entire sunspot cycle, was released in 1971. CCIR (International Radio Consultative Committee) has re-stressed the needs for continued study on night-time medium frequency propagation curves and formulas for world-wide applications. The method that has been adopted by the European Broadcasting Union (EBU) is referred to as the EBU method for simplicity. In addition to this, a new method has been proposed by U.S.S.R. This method has been well received in the EBU area and CCIR has solicited comments from all administrations. GRA

N76-21376# Air Force Weapons Lab., Kirtland AFB, N.Mex.
MESSAGE RECEIPT PROBABILITIES Final Report
Theodore M. Hardebeck and John M. Kamm, Jr. Nov. 1975 27 p ref
(AF Proj. 8809)
(AD-A017852; AFWL-TR-75-172) Avail: NTIS CSCL 17/2

A method for evaluating digital communication systems performance is given. This method involves calculating the probability that a formatted message transmitted by the system is correctly received. Communication systems which employ radio wave propagation are susceptible to degradation of the propagated signal. Degradation of the signal occurs even in normal conditions because of various disturbances to the medium through which the signal passes. Nuclear detonation, far more so, produce severe disturbances. There are mathematical models incorporated in computer codes which assist in rapid calculation of various quantities used to describe degradation. These quantities include: signal absorption and signal to noise ratio. For the commander, these quantities do not answer the main question, which is, will the system perform its mission. This report is an attempt to bridge the gap between the output of the system codes and the data required for command decisions. To do this, the probability of receiving a correct message is calculated. This message probability is an easily understood measure of system performance upon which command decisions can be based.GRA

N76-21377# Naval Research Lab., Washington, D.C.
OBSERVATIONS OF ELF SIGNAL AND NOISE VARIABILITY ON NORTHERN LATITUDE PATHS Interim Report
John R. Davis and William D. Meyers 11 Nov. 1975 22 p refs
(NRL Proj. R07-25)
(AD-A018086; NRL-7923) Avail: NTIS CSCL 20/14

Extremely-low-frequency (ELF) signal and noise data from a network of receiving sites in the North Atlantic region are reported for propagation tests that were conducted in 1974 and early 1975. Statistics of the signal and noise behavior indicate that variability introduced by geophysical phenomena in the ionosphere are of significance and that this variability exists to some degree even under seemingly quiet conditions. A correspondence is observed between periods of unusually disturbed ELF propagation and geomagnetic activity, indicating that charged particles precipitated from the magnetosphere following solar eruptions are responsible for the propagation variability. Author (GRA)

N76-21378# Science Applications, Inc., McLean, Va.
SOURCE REGION EMP CALCULATIONS Final Report, Sep. 1974 - Aug. 1975
William L. Chadsey, E. Roland Parkinson, and Vernon W. Pine Jun. 1975 82 p refs
(Contract DAAG39-75-C-0034; HDL Proj. E055E3; DNA Proj. NWED-QAXEB088)
(AD-A017696; SAI-75-502-WA; HDL-CR-75-622-1) Avail: NTIS CSCL 20/14

Source region EMP and close-in coupling calculations were performed in support of a source region EMP simulation experiment performed in the AURORA flash X-ray environment. Calculations were performed of the photon transport and electron transport to obtain the EMP drivers within an air-filled right circular cylinder. Maxwell's equations were solved by a finite difference technique to obtain the EMP fields and the current coupled to right circular cylindrical body within the cylindrical test chamber. Author (GRA)

N76-21379# Stanford Research Inst., Menlo Park, Calif.
UHF ELECTRONICALLY TUNABLE HIGH POWER FILTER Final Technical Report, 1 Apr. 1974 - 31 Mar. 1975
Arthur Karp and Louis N. Heynick Sep. 1975 147 p
(Contract F30602-74-C-0142)
(AD-A018044; RADC-TR-75-220) Avail: NTIS CSCL 17/2

This report describes the development of a double-resonator, high-power bandpass filter for the frequency range 355 to 400 MHz that employs the 'Flauto' principle to obtain binary-programmed, high-speed electronic tuning with application to interference reduction in Air Force UHF communications systems. The accompanying control and test hardware and software are also described. GRA

N76-21380# University of Southern Calif., Marina del Rey. Information Sciences Inst.
DIALOGUE-BASED RESEARCH IN MAN-MACHINE COMMUNICATION
William C. Mann Nov. 1975 36 p refs
(Contract N00014-75-C-0710; ARPA Order 2930; NR Proj. 154-374; RR0420601)
(AD-A017681; ISI/RR-75-41) Avail: NTIS CSCL 17/2

This paper first surveys current knowledge of human communication from a point of view which seeks to find or develop knowledge that will be useful to computer system designers. The relevant scientific knowledge is found to be fragmentary and hard for designers to use. Next, the problem of complexity is explored. Building a useful knowledge of human communication is an extremely complex task. Controlling this complexity and its effects, without giving up usefulness, is seen as the central problem in designing a research approach. Finally, a new research methodology is presented. It contains some innovations that help control the complexity of the task, and others that make the results useful to designers. The methodology is unique in that it is based on case analysis rather than functional system design, the results are in the form of individual computer algorithms (much smaller than systems), and the algorithms are transferable into useful (nonresearch) systems. GRA

N76-21381# Ohio State Univ., Columbus. ElectroScience Lab.
CONTINUATION OF THE INVESTIGATION OF MULTI-FREQUENCY RADAR REFLECTIVITY AND RADAR TARGET IDENTIFICATION Scientific Report, 1 Jul. 1974 - 30 Jun. 1975
D. L. Moffatt, R. C. Rudduck, C. W. Chuang, and J. A. Aas Jul. 1975 35 p refs
(Contract F19628-72-C-0203; AF Proj. 5635; AF Proj. 6813) (AD-A018041; ESL-3424-5; AFCRL-TR-75-0417; SR-5) Avail: NTIS CSCL 17/9

This report summarizes research during the period July 1, 1974 to June 30, 1975 under the contract on two technical objectives of the Air Force: improved detection and discrimination of radar targets and reduction of nonspecular scattering by wing geometries. The report is contained in two main sections. The first section outlines methods for deducing the complex natural resonances of arbitrary radar targets and the use of these resonances via predictor-correlator processing for detection and discrimination. Illustrative examples of both natural resonance extraction and discrimination are given for aircraft targets. The second section of the report summarizes the analysis of a loaded two-dimensional wind model for horizontal polarization. Hybrid techniques combining moment methods and the geometrical theory of diffraction are used and the loading consists of surface impedance patches. Examples of reduction of the nonspecular cross section are given. A 'folded dipole' like antenna is used as an alternate mechanism for controlling edge diffracted fields. GRA

N76-21382# Naval Research Lab., Washington, D.C.
MULTICHANNEL DATA ACQUISITION AND RETRIEVAL SYSTEM Final Report
William A. Barnwell Nov. 1975 19 p refs
(NRL Proj. K04-07)
(AD-A018050; NRL-MR-3142) Avail: NTIS CSCL 17/9

A multichannel data acquisition and retrieval system developed for a recent program has provided an effective means of documenting field tests of an experimental airborne radar system. The system provided transducers to sample a variety of experimental, environmental, and radar system parameters. Using conventional telemetry techniques the system stores and recovers the various parameters and 'voice log' from a restricted bandpass record channel. As a consequence of the techniques employed, the system provides a means of simultaneously documenting radar video recorded by an AMPEX AR-500 airborne video recorder during field tests through the use of its auxiliary record channel. In addition, the system provides a reliable and convenient display of the recovered parameters during the subsequent analysis of field tests by NRL personnel. Finally, the system can be readily adapted to new documentation requirements. GRA

N76-21383# Naval Research Lab., Washington, D.C.
DETECTION OF STATIONARY TARGETS IN SEA CLUTTER USING A CW DUAL-FREQUENCY RADAR Interim Report
William J. Plant 11 Nov. 1975 15 p refs
(NRL Proj. R02-37; RR0210141)
(AD-A018134; NRL-7934) Avail: NTIS CSCL 17/9

A coherent, CW, X-band, dual-frequency radar has been used to detect stationary targets in the Chesapeake Bay. It is shown that by multiplying returns at two frequencies and averaging, sea clutter is suppressed. If the decorrelation of the two clutter returns is greater than that of returns from a stationary target, the signal-to-clutter ratio of the two-frequency system is shown to be greater than that of a comparable single-frequency radar. Author (GRA)

N76-21384# Facility Checking Squadron (1868th) (AFCS), APO New York 09332.
SPECIAL EVALUATION REPORT, THE EFFECTS OF AIRCRAFT VELOCITY ON MTI SYSTEMS TRACALS Evaluation Report
23 Oct. 1975 35 p refs
(AD-A017767; Rept-75/68-R-14) Avail: NTIS CSCL 17/9

This Special Evaluation was designed to provide the air traffic controller and radar maintenance technician with an understanding of the performance capabilities and limitations of various types of radar Moving Target Indicator (MTI) systems and the associated blind speeds. Contained in this report are data identifying and documenting the width and depth of the blind speed notch in the AN/MPN-series and AN/FPN-47 airport surveillance radars. Discussions of test configurations, test methods, analysis of the collected data, conclusions that were derived from the analysis and recommendations to assure the best possible equipment configuration are also contained in this report. Author (GRA)

N76-21385# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
UPPER-BOUND ERRORS IN FAR-FIELD ANTENNA PARAMETERS DETERMINED FROM PLANAR NEAR-FIELD MEASUREMENTS. PART 1: ANALYSIS
Arthur D. Yaghjian Oct. 1975 123 p refs Sponsored by AFAL
(PB-247941/8; NBS-TN-667-Pt-1) Avail: NTIS HC$5.50 CSCL 09E

General expressions are derived for estimating the errors in the sum or difference far-field pattern of electrically large aperture antennas which are measured by the planar near-field scanning technique. Upper bounds are determined for the far-field errors produced by (1) the nonzero fields outside the finite scan area, (2) the inaccuracies in the positioning of the probe, (3) the distortion and nonlinearities of the instrumentation which measures the amplitude and phase of the probe output, and (4) the multiple reflections. Computational errors, uncertainties in the receiving characteristics of the probe, and errors involved with measuring the input power to the test antenna are briefly discussed. GRA

N76-21386# Naval Research Lab., Washington, D.C.
FAST COMPLEX CONVOLUTION USING NUMBER THEORETIC TRANSFORMS
Emanuel Vegh and Lawrence M. Leibowitz 17 Nov. 1975 19 p refs
(AD-A018053; NRL-7935) Avail: NTIS CSCL 09/4

It is shown that discrete circular convolution of complex number sequences may be carried out without arithmetic roundoff

error using a family of number theoretic transforms defined in a finite ring. In certain cases the arithmetic of this transform may involve only additions, subtractions, and circular bit shifts and may be implemented with an FFT type procedure. As an application it is shown that the discrete Fourier transform may be computed with these transforms. GRA

N76-21387# National Bureau of Standards, Washington, D.C.
PLANE-WAVE SATTERING-MATRIX THEORY OF ANTENNAS AND ANTENNA-ANTENNA INTERACTIONS: FORMULATION AND APPLICATIONS
David M. Kerns Jan. 1975 99 p refs
(PB-247940/0; NBSIR-75-824) Avail: NTIS HC $5.00 CSCL 09E

The paper presents and extends the basic plane-wave scattering-matrix formalism (PWSM) and presents new generalized or adjoint reciprocity relations for antennas. The PWSM formalism is eminently suitable for the formulation and solution of problems involving interactions at arbitrary distances and for the expression of conventional asymptotic quantities, such as gain, effective area, and polarization. It has in particular enabled derivation of two new techniques that permit accurate, 'probe-corrected' antenna measurements at greatly reduced distances. GRA

N76-21388# Office of Telecommunications Management, Washington, D.C.
SENSOR PATH LOSS MEASUREMENTS ANALYSIS AND COMPARISON WITH PROPAGATION MODELS
Anita G. Longley and George A. Hufford Oct. 1975 186 p refs
(PB-247638/0; OTR-75-74) Avail: NTIS HC $7.50 CSCL 20N

The data from a large measurement program at VHF and UHF are carefully evaluated, summarized and compared with values predicted from models of radio propagation over irregular terrain. Particular problems of low antennas and the effects of vegetation are considered. Modifications in prediction models are suggested for particular application to sensor systems. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N76-21389 British Broadcasting Corp., Kingswood (England). Engineering Div.
SOLID STATE IMAGE SENSORS: IMPROVEMENTS IN SIGNAL PROCESSING TECHNIQUES
G. M. LeCouteur Jan. 1976 16 p refs
(BBC-RD-1976/4) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The use of a single dimension 512 element array for film scanning resulted in the production of pictures from film using a 512 element switched-diode array, while the pictures were of fairly good quality, they fell short of normal broadcast standards for two principle reasons; one was the insufficient resolution obtained and the other was the presence of fixed pattern noise appearing as vertical stripes in the picture background. Techniques which have been developed to combat these effects are described and the picture quality now obtainable is assessed. Author

N76-21390* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TRIELECTRODE CAPACITIVE PRESSURE TRANSDUCER Patent
Grant W. Coon, inventor (to NASA) Issued 6 Apr. 1976 13 p Filed 17 Jul. 1975 Supersedes N75-29320 (13 - 20, p 2512) Division of abandoned US Patent Appl. SN-493363, filed 31 Jul. 1974
(NASA-Case-ARC-10711-2; US-Patent-3,948,102; US-Patent-Appl-SN-596788; US-Patent-Class-73-398C; US-Patent-Class-317-246; US-Patent-Appl-SN-493363) Avail: US Patent Office CSCL 09A

A capacitive transducer and circuit especially suited for making measurements in a high-temperature environment are described. The transducer includes two capacitive electrodes and a shield electrode. As the temperature of the transducer rises, the resistance of the insulation between the capacitive electrode decreases and a resistive current attempts to interfere with the capacitive current between the capacitive electrodes. The shield electrode and the circuit coupled there reduce the resistive current in the transducer. A bridge-type circuit coupled to the transducer ignores the resistive current and measures only the capacitive current flowing between the capacitive electrodes.
Official Gazette of the U.S. Patent Office

N76-21391*# General Electric Co., Schenectady, N.Y. Corporate Research and Development.
DEVELOPMENT AND FABRICATION OF IMPROVED SCHOTTKY POWER DIODES
L. F. Cordes, M. Garfinkel, and E. A. Taft Nov. 1975 118 p refs
(Contract NAS3-16749)
(NASA-CR-134925; SRD-75-127) Avail: NTIS HC $5.50 CSCL 09A

Reproducible methods for the fabrication of silicon Schottky diodes have been developed for tungsten, aluminum, conventional platinum silicide, and low temperature platinum silicide. Barrier heights and barrier lowering under reverse bias have been measured, permitting the accurate prediction of forward and reverse diode characteristics. Processing procedures have been developed that permit the fabrication of large area (about 1 sq cm) mesageometry power Schottky diodes with forward and reverse characteristics that approach theoretical values. A theoretical analysis of the operation of bridge rectifier circuits has been performed, which indicates the ranges of frequency and voltage for which Schottky rectifiers are preferred to p-n junctions. Power Schottky rectifiers have been fabricated and tested for voltage ratings up to 140 volts. Author

N76-21392*# National Aeronautics and Space Administration, Washington, D.C.
DISPLAYS, MEMORIES, AND SIGNAL PROCESSING: A COMPILATION Technology Utilization
Aug. 1975 45 p
(NASA-SP-5972(06)) Avail: NTIS HC $1.00 CSCL 09C

Articles on electronics systems and techniques were presented. The first section is on displays and other electro-optical systems; the second section is devoted to signal processing. The third section presented several new memory devices for digital equipment, including articles on holographic memories. The latest patent information available is also given. Author

N76-21393# California Univ., Livermore. Lawrence Livermore Lab.
THOMSON SCATTERING OF LASER LIGHT FROM A PLASMA Quarterly Report
A. L. Peratt 1 May 1975 33 p refs Sponsored by ERDA
(UCRL-50025-75-2; QR-2) Avail: NTIS

An experiment designed to extract information about plasma densities, temperatures, and magnetic fields in a dynamic pinch plasma by means of ruby laser light is presented. In addition, techniques involving the heterodyne detection of longer wavelength lasers are discussed, providing for the diagnostics of plasmas with densities ranging from 10 to the 11th power per cc through those associated with dense plasma focus and with temperatures of a few eV to several keV. Author (NSA)

N76-21394# Sandia Labs., Albuquerque, N.Mex.
STUDIES OF TANTALUM NITRIDE THIN FILM RESISTORS
R. A. Langley 1975 23 p refs Presented at Intern. Conf. on Ion Beam Surface Layer Analysis, Karlsruhe, West Ger., 15 Sep. 1975 Sponsored by ERDA
(SAND-74-7006; Conf-750949-5) Avail: NTIS HC $4.25

Backscattering of 2-MeV He ions was used to correlate the electrical properties of sputtered TaN/sub x/ thin film resistors with their N content. The properties measured were sheet resistance, differential Seebeck potential (DSP), thermal coefficient

of resistance (TCR), and stability. Resistivity and DSP are linearly dependent on N content for N/Ta ratios of 0.25 to 0.55. TCR decreases sharply below N/Ta equals 0.35 and is relatively constant from 0.35 to 0.55. Stability is independent of N content. NSA

N76-21395# Sandia Labs., Albuquerque, N.Mex.
REVIEW OF ELECTRICAL SWITCH DESIGN FACTORS FOR HIGH RELIABILITY SPACE AND WEAPONS APPLICATIONS
R. E. Cuthrell Mar. 1975 18 p refs
(Contract AT(29-1)-789)
(SAND-75-0181) Avail: NTIS HC $4.00

In order to improve the design of electrical switches for a particular type of operations, the designer must be aware of the physical and chemical phenomena which may be expected to affect their operation during their predicted life. He should be aware of the sources of contamination and he should design for contaminant exclusion or control, for cleaning, and for decreased sensitivity to contamination. The selection of contract materials and geometry should be consistent with the application, the switch design must be consistent with the circuit parameters, and the test procedures must be specified for the design. Author (NSA)

N76-21396# Commissariat a l'Energie Atomique, Saclay (France). Dept. du Synchrontron Saturne.
PREDICTION OF MAXIMUM QUENCHING CURRENTS IN COILS MADE OF HIGH CURRENT MULTIFILAMENTARY COMPOSITES OR MULTISTRAND CABLES
J. L. Duchateau and B. Turck 21 Apr. 1975 5 p refs Presented at 5th Intern. Conf. on Magnet Technol., Frascati, Italy, 21-25 Apr. 1975
(CEA-Conf-3065; Conf-750438-8) Avail: ERDA Depository Libraries HC $4.00

For superconducting magnets of high current composites, the maximum performance is often limited by the so-called degradation. One fundamental reason arises from the fact that if transposition of the filaments in a composite allows complete sharing of the transport current, twisting does not. As a result, the filaments behave collectively, and the overall self field can give rise to a catastrophic flux jump. The stability of multifilamentary composites is examined with respect to possible composites and current levels. Expressions and curves are useful for determining quenching currents in coils under various cooling. Author (NSA)

N76-21397# California Univ., Berkeley. Lawrence Berkeley Lab.
HIGH PERFORMANCE MAGNET POWER SUPPLY OPTIMIZATION
L. T. Jackson 1975 5 p refs Presented at Particle Accelerator Conf., Washington, D. C., 12 Mar. 1975
(Contract W-7405-eng-48)
(LBL-3375; Conf-750335-62) Avail: NTIS HC $4.00

Three types of magnet power supply systems for the joint LBL-SLAC proposed accelerator PEP are discussed. The systems considered include a firing circuit and six-pulse controlled rectifier, transistor systems, and a chopper system. NSA

N76-21398# European Space Agency, Paris (France).
ELECTRONIC COMPONENT DATABANK: RESISTANCE REFERENCE BOOK
1975 125 p refs In ENGLISH and FRENCH
(ESA-ECDB-1) Avail: NTIS HC $5.50

Basic reference information on electrical resistors was presented, including the following data: physical characteristics, manufacturer, model designation, and dimensions. Author (ESA)

N76-21399# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
ANALYSIS OF THREE CONDUCTOR COAXIAL SYSTEMS. COMPUTER-AIDED DETERMINATION OF THE FREQUENCY CHARACTERISTICS AND THE IMPULSE AND STEP RESPONSE OF A TWO-PORT CONSISTING OF A SYSTEM OF THREE COAXIAL CONDUCTORS TERMINATING IN LUMPED IMPEDANCES
J. VanDerPlaats Mar. 1975 40 p refs
(TH-74-E-56; ISBN-90-6144-056-4) Avail: NTIS HC $4.00

A system consisting of three coaxial conductors of a certain length terminating in concentrated elements is a configuration applied in coaxial shunts. Based on Maxwell's equations, expressions are derived describing the field intensities in the conductors and in the intermediate dielectrics. The four quasi TEM propagation modes, inherent in three parallel conductors, are derived from the characteristic determinant of the system and are used to obtain general expressions for the currents and the voltages in the system. Applying the terminal conditions in conformity with the use of the system as a coaxial shunt, the eigenvalue of the two-port concerned is determined. The inverse Fourier transform then leads to the impulse response of the two-port from which the step response is derived by integration. Computational results are given of the transfer impedance and the responses in the time domain. Author (ESA)

N76-21400# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
RAY-OPTICAL ANALYSIS OF A TWO-DIMENSIONAL APERTURE RADIATION PROBLEM
P. J. H. VanKalken and C. Kooy Aug. 1975 48 p refs
(TH-75-E-57; ISBN-90-6144-057-2) Avail: NTIS HC $4.00

The radiation from the open end of a parallel plane waveguide with slots at both edges was analyzed with the help of Keller's geometrical theory of diffraction. Comparison of the results with the known solution for the same problem without slots shows that the effect of the slots with respect to amplitude and phase of the radiation is significant for the amplitude distribution only. Subsequently special attention is given to the problem of two-dimensional diffraction at an edge, when the latter is situated on the shadow boundary of the incident radiation. This situation presents itself as a sub-problem in the above-mentioned parallel plane waveguide diffraction problem. A modification of Sommerfeld's classical method makes it possible to attack this problem. The first correction term in the half plane diffraction coefficient was found. Author (ESA)

N76-21401# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
SOME ASPECTS OF GROUND STATION ANTENNAS FOR SATELLITE COMMUNICATION Ph.D. Thesis
E. J. Maanders Aug. 1975 175 p refs
(TH-75-E-60; ISBN-90-6144-060) Avail: NTIS HC $6.75

The advantages and disadvantages of the front-fed paraboloid and the Cassegrain antenna were compared for satellite communication ground stations at 4 - 6 GHz. It appears that the Cassegrain antenna has much better noise properties. The problems with regard to blockage in double reflector systems were studied in detail. The influence of the subreflector and its supports on the near-in sidelobes was calculated. Different results may be expected in the phi = 0 deg and phi = 45 deg plane. Various examples were worked out with regard to the blockage efficiency. A theory is presented indicating that the blockage efficiency may be increased considerably, employing shaped double reflector systems. Shaping both main and subreflector a low subreflector edge illumination may be used, decreasing losses by diffraction and spillover. It appears that in mismatched shaped systems large first sidelobes are to be expected due to over illumination of the edge of the main reflector. The physical optics approximation is discussed as a method to calculate the entire radiation pattern of a reflector antenna. The limitations and errors that occur with this method were studied. Using theoretical truncated feed patterns, the directive gain pattern of the composite antenna system, integrated over the entire sphere does not yield 4 pi, but more. The polarization properties of offset antennas are discussed. These properties are very unfavorable in respect to symmetrical front-fed paraboloids and Cassegrain antennas. Author (ESA)

N76-21402 IIT Research Inst., Chicago, Ill. Reliability Analysis Center.
MICROCIRCUIT RELIABILITY BIBLIOGRAPHY. VOLUME 1-A: CUMULATIVE INDEX. VOLUME 2: CUMULATIVE REFERENCES. VOLUME 3: 1975 ANNUAL REFERENCE SUPPLEMENT DOCUMENT NUMBERS: 10417 - 11044
Apr. 1975 656 p refs

(Contract F30602-73-C-0065)
(AD-A011699; RAC-MRB-0474) Avail: Issuing Activity CSCL 09/5

The bibliography identifies selected literature pertinent to the reliability of micro-electronic devices. This two-volume publication updates the bibliography which now consists of three volumes: IA, II and III. Volume IA contains a categorized subject term index, as well as corporate author and 1975 personal author indices. The indices cross-reference bibliographic citations presented in Volume II, Cumulative References (previously issued) covering acquisitions through February 1974, and Volume III, 1975 Annual Reference Supplement which includes acquisitions for the period March 1974 through February 1975. These reference volumes contain over 3,000 citations which were selected from the Reliability Analysis Center's file holdings. Citations include complete bibliographic information and descriptive abstracts. The complete Microcircuit Reliability Bibliography enables the engineer or technical librarian to perform retrospective information searches in a wide variety of pertinent subject areas. GRA

N76-21403# Pennsylvania Univ., Philadelphia. Dept. of Mechanical Engineering and Applied Mechanics.
THE TWO-DIMENSIONAL, CONSTANT PROPERTY ARC Interim Report
Ira M. Cohen and Alan M. Whitman Aug. 1975 37 p refs Submitted for publication Sponsored by Elec. Power Res. Inst.
(PB-246649/8; MEAM-75-4; EPRI-RP-378-1/1) Avail: NTIS HC $4.00 CSCL 20/3

The theory of the (1-dimensional) constant property arc was extended to a planar arc in two dimensions. The use of a canal model and the canal boundary temperature is discussed. The Elenbaas-Heller equation was solved for arc temperature distributions subject to Ohm's law and current conservation. Temperatures on the bounding walls and electrodes are specified. The principal parameters of this study are the length (interelectrode distance) to width (between bounding walls) ratio and the conducting spot size (or maximum temperature) on the electrodes. GRA

N76-21404# Ohio State Univ. Research Foundation, Columbus.
DEVELOPMENT OF FIELD EFFECT RADIATION DETECTORS FOR USE IN INFRARED SENSING AND IMAGING DEVICES Final Report, 7 Jun. 1973 - 21 May 1975
A. S. Zolnay and D. W. Miller Jun. 1975 80 p refs
(Contract DAAK02-73-C-0366)
(AD-A018182; OSURF-3697-14) Avail: NTIS CSCL 20/12

A pyroelectric field effect device has been developed using surface charge, which compensates the net temperature-dependent dipole moment of a pyroelectric substrate, to modulate the conductivity of a semiconductor surface film. A tellurium semiconductor film, chosen to match the lattice structure of the ceramic pyroelectric substrate, lanthanum-doped lead zirconate titanate, was vapor deposited or sputtered onto both sides of the substrate to form a unique two-sided field effect device configuration. The most reliable deposition technique used in this study was dc cathodic sputter cleaning prior to vapor deposition. The theoretical model proposed in the study predicts a maximum field effect response to radiation with a low impedance between the two sides of the device. The noise model identifies noise sources originating from thermal fluctuations (Johnson-Nyquist noise) in the semiconductor film channel resistance and the drain-source load resistor, temperature fluctuations in the substrate, and recombination noise in the pyroelectric substrate-semiconductor interface. GRA

N76-21405# Army Electronics Command, Fort Monmouth, N.J.
PROCEEDINGS OF 24TH INTERNATIONAL WIRE AND CABLE SYMPOSIUM
Nov. 1975 426 p refs Symp. held at Cherry Hill, N. J., 18-20 Nov. 1975
(AD-A017787) Avail: NTIS CSCL 09/1

Subjects covered at the conference included: (1) tutorial on wire and cable considerations in fires; (2) flammability considerations in cables; (3) manufacturing and processing; (4) cable applications; (5) cable design; (6) testing and evaluation; (7) Cable materials; and (8) waterproof cable. Author

N76-21406# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIATION DAMAGE TO JUNCTION AND MOS TRANSISTORS
S. Demes, P. Pellionisz, and F. Szlavik 12 Nov. 1975 14 p refs Transl. into ENGLISH Meres Automat. (Hung.), v. 17, no. 3, 1969 p 85-89
(AD-A017883; FTD-ID(RS)I-2187-75) Avail: NTIS CSCL 09/1

Investigations of radiation induced damage of such transistors are reported which find application in electronic equipments explosed to nuclear sources of high intensity. The mechanism of the effect of radiation is described and it is shown that in the case of nuclear reactors the effect of fast neutrons is of critical importance. In the experiments on OC 44K and MOS FET transistors irradiated in the core of a VVRS-reactor the radiation effect was manifested in both types most markedly by the decrease in collector corrent, appreciable in the former already at a fast neutron dose of 10 to the 13th power n/cm squared while in the latter at doses higher by 1-2 orders of magnitude. The experimental data may be helpful to determine the optimum location of an electronic equipment containing radiation sensitive elements and the appropriate choice of the nuclear shielding. GRA

N76-21407# Hughes Aircraft Co., Torrance, Calif.
MULTITONE TROPOSCATTER TUBE (G-BAND) Final Report, 1 Aug. - 31 Dec. 1974
I. Tammaru Jul. 1975 94 p refs
(Contract DAAB07-75-C-1283)
(AD-A017955; W76-06176; ECOM-75-1283-F) Avail: NTIS CSCL 09/1

The objective of the study was to optimize the design of G-band TWTs capable of amplifying between 4 and 16 equal-amplitude signals with a carrier-to-IM distortion power ratio of at least 20 dB, and demonstrating an overall efficiency of 25 percent minimum. The approach was to operate the tubes backed off from saturation to fulfill the distortion specification, and incorporate a four-stage depressed collector to achieve the efficiency. Detailed designs satisfying the requirements were established by computer analysis. The best designs had uniform RF circuits, which were operated closer to synchronism than in standard TWTs. The overall efficiency was 27 percent minimum in the band 4.4 - 5.0 GHz for both a PPM-focused 1 kW tube and a solenoid-focused 10 kW tube (including solenoid power). GRA

N76-21408# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE STATIC STABILITY OF LONG-DISTANCE ac TRANSMISSIONS WITH RESPECT TO EQUIVALENT TRANSFER FUNCTIONS AND THE STATIC CHARACTERISTICS OF INTERMEDIATE SYSTEMS
R. I. Borisov, V. I. Gotman, and Yu. V. Khrushchev 19 Nov. 1975 14 p Transl. into ENGLISH from Tr. Sibrisk.-Nauch.-Issled. Inst. Energ., Akad. Nauk SSSR (USSR), no. 21, 1972 p 268-274
(AD-A017930; FTD-ID(RS)i-2320-75) Avail: NTIS CSCL 09/1

The essential difficulty of investigating the static stability of long-distance transmissions with intermediate electric power systems is the complexity of their initial calculation circuits. In order to overcome these difficulties a technique was developed for replacing the systems adjacent to the electric power transmission line (LEP) with equivalent transfer functions and static characteristics. GRA

N76-21409# RCA Labs., Princeton, N.J.
BASIC ADHESION MECHANISMS IN THICK AND THIN FILMS Quarterly Technical Report, 1 Jan. - 31 Mar. 1975
Kenneth R. Bube and Thomas T. Hitch 30 Apr. 1975 37 p refs
(Contract N00019-75-C-0145)
(AD-A017736; PRRL-75-CR-18; QTR-1) Avail: NTIS CSCL 09/1

During this quarter silver and gold powders were obtained for model ink studies. These consisted of a flake silver and spherical and mixed sphere and platelet gold powders. In addition,

a copper powder was produced by direct reduction of copper oxide powder at low temperature, e.g., 150C. All powders have been partially characterized with respect to chemical purity and morphological attributes, e.g., shape and size distribution. The degree of sintering in metal powder compacts has been established as a function of firing temperature. Except for copper, all of the powders showed significant shrinkage when fired at 600C. Glass-ceramic and glass-metal wetting behavior was studied by measuring glass sessile-drop contact angles as a function of firing temperature and time. In all cases, glass preferentially wetted the metal, e.g., gold, silver, or copper vs 96% Al2O3 substrates. GRA

N76-21410# RCA Labs., Princeton, N.J.
BASIC ADHESION MECHANISMS IN THICK AND THIN FILMS Quarterly Technical Report, 1 Apr. - 30 Jun. 1975
Thomas T. Hitch and Kenneth R. Bube 31 Jul. 1975 55 p refs
(Contract N00019-75-C-0145)
(AD-A017737; PRRL-75-CR-43; QTR-2) Avail: NTIS CSCL 09/1

In this quarter, continued experiments were conducted to separate and quantify the chemical from the micromechanical contributions to the adhesion strength. It was shown that silver has a higher chemical adhesion than gold to a glass of composition similar to that of frits used in commercial thick-film conductors. Isothermal sintering studies of gold, silver, and copper powders in the presence and absence of the liquid glass phase showed that densification rates and microstructure differed markedly in each metal powder. Large densification rate differences were also noted in gold powders with different morphologies and particle size distributions. During this quarter, the possibility was considered that reactively and mixed-bonded inks have a common or similar adhesion mechanism. The results of several recent experiments, which are presented, lead to the consideration of such a mechanism. GRA

N76-21411# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Guidance and Control Directorate.
THERMAL ANALYSIS OF THE RFSS SWITCH DRIVER
Vernon A. Nieberlein 18 Sep. 1975 23 p refs
(AD-A018170; RG-76-21) Avail: NTIS CSCL 09/1

Overheated microelectronic circuits caused some equipment failures in a device known as the RFSS switch driver. A thermal analysis was made of this equipment using the CINDA computer code, and the mathematical model was validated by thermocouple readings. The effect of package material and the effect of convective cooling fins were calculated and the results are presented in graphic form. Recommendations are made for improving the dissipation of heat. GRA

N76-21412# USCC/CENTRALAB, Los Angeles, Calif.
MANUFACTURING METHODS AND TECHNOLOGY PROJECT TO ESTABLISH AND IMPROVE THE PRODUCIBILITY OF SILK SCREENING AND LAYERING OF CERAMIC DIELECTRIC CAPACITORS Quarterly Report, 27 Jun. - 1 Oct. 1975
Jack Floegel 1 Oct. 1975 29 p
(Contract DAAB07-75-C-0041)
(AD-A018115; Rept-75-10-01; QR-1) Avail: NTIS CSCL 09/1

The purpose of the manufacturing methods and technology Program is to provide the production engineering necessary to establish facilities and materials for manufacturing high reliability ceramic chip capacitors. This Quarterly Progress Report describes the work completed during the First Reporting Period of the Contract. GRA

N76-21413# Solid State Research Corp., Scottsdale, Ariz.
INTEGRATED DEVICE ANALYSIS MODELING AND DESIGN Final Report, 1 Feb. 1973 - 1 Jan. 1975
James L. Dunkley, Y. N. Bayazit, and A. C. Tickle Sep. 1975 283 p refs
(Contract F33615-73-C-1101; AF Proj. 6096-0125)
(AD-A018121; AFAL-TR-75-169) Avail: NTIS CSCL 09/1

This report presents the results of a study of a multi-section, two dimensional non-linear transistor and resistor model amenable to computer analysis for significantly improved circuit analysis compatible with SCEPTRE, TRAC, and TIME. Theoretical considerations were primarily developed by the staff of Solid State Research Corporation. However, the works of other workers were of inestimable value and were used as indicated by footnotes. As an aid to the future users, a section is included with the calculation examples which should be a valuable aid to the device design engineer in making the desired tradeoffs when designing high speed transistors and resistors. GRA

N76-21414# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
EXPERIMENTAL HYSTERETIC LOSS FOR A SERIES OF SUPERCONDUCTING FILAMENTARY Nb Ti WIRES AND A FIELD DEPENDENT CRITICAL STATE MODEL Final Technical Report, 2 Oct. 1972 - 31 Dec. 1973
Melvin C. Ohmer, John J. Wollan, and Larry O. Lawson Jul. 1975 130 p
(AF Proj. 7371)
(AD-A018128; AFML-TR-75-10) Avail: NTIS CSCL 20/3

This report summarizes the Air Force superconducting wire applications, the goals of future superconducting materials development, the state of the art theories of ac loss in superconductors, and the results of hysteretic loss measurements on a series of niobium titanium multifilamentary wires. Expressions were developed for magnetization and hysteretic loss for half cycle and full cycle for rod geometries for a critical state model with critical current inversely proportional to field. Bulk effects with surface like character are discussed along with surface shielding fields and the demagnetizing factor. The loss expressions of various models are compared to experimental loss. Universal loss curves constructed from experimental loss curves by appropriate normalization are obtained and used to predict loss accurately. GRA

N76-21415# Army Foreign Science and Technology Center, Charlottesville, Va.
INCREASING THE OPERATING SPEED OF INTEGRATED CIRCUITS MADE OF MOS TRANSISTORS
A. V. Zelentsov and V. M. Gusakov Aug. 1975 13 p refs Transl. into ENGLISH from Elektronnaya Promyshlennost (USSR), no. 4, 1971 p 22-25
(AD-A018206; FSTC-HT-23-808-75) Avail: NTIS CSCL 09/1

Integrated circuits which employ Bipolar transistors as opposed to metal oxide semiconductor (MOS) transistors, operate at a much higher speed. The cause for lower operating speeds of integrated circuits using MOS transistors are channel resistance and parasitic capacitance in the transistor, which results from gate metallization overlap of source and drain diffusion areas. Various methods are proposed to alter MOS transistor capacitances and resistances to improve operating speed. One technique, called ion alloying, is proposed, which can improve MOS transistor electrical properties. Another method is the fabrication of MOS circuits and transistors on dielectric substrates such as sapphire, spinel, and polycrystalline silicon. The use of charge coupled devices to increase the operating speed of MOS circuits is also examined. J.R.T.

N76-21416# Massachusetts Inst. of Tech., Cambridge.
SUPERCONDUCTORS IN LARGE SYNCHRONOUS MACHINES Final Report
J. L. Smith Sep. 1975 119 p refs Sponsored by Elec. Power Res. Inst.
(PB-247636/4; EPRI-92-2) Avail: NTIS HC $5.50 CSCL 10B

Research was organized around three major actitivies: (1) two complete superconducting alternators were designed, constructed, tested and evaluated; (2) design studies of full-scale turbine generators were iterated three times resulting in the design of the 3MVA machine and the use of experimental results from the 3-MVA machine in the optimization of the design of full-scale turbine generators; and (3) development of concepts and analytic methods for the design of superconducting machines has included overall electrical analysis of the machine based on two-dimensional magnetic field models, machine dynamic performance including fault transients, cryogenic design and optimization, and analysis of new machine concepts. GRA

N76-21417# Radio Corp. of America, Burlington, Mass. Government Communications and Automated Systems Div.
CAMERA TUBE FOR SPACE SURVEILLANCE Final Report, 1 Apr. - 29 Nov. 1974
M. J. Cantella, T. W. Edwards, R. W. Engstrom, O. H. Schade, Sr., and M. W. Stewich Sep. 1975 161 p refs
(Contract F33615-74-C-1089; AF Proj. 2126)
(AD-A016481; AFAL-TR-75-79) Avail: NTIS CSCL 09/1

The design study included parametric analysis of the factors which affect the design of camera tubes for space surveillance. Surveillance, expressed in terms of sensitivity, coverage, and angular velocity cutoff, can be maximized by increasing the spatial resolution (N sub e) and format size of the sensor. To achieve photoelectron noise limited surveillance, pretarget gain is necessary. The best approach for obtaining this gain at high resolution is the use of a magnetically focussed intensifier section coupled to a magnetically focussed and deflected scanning section. This can be accomplished in a timely manner with low technical risk by coupling either a single silicon impact ionization or a double intensifier section to the scanning electron optics of the 4-1/2-inch Return Beam Vidicon. This tube would have a 72mm target and a resolution (N sub e) level eight times greater than that of currently available sensors. Typical space surveillance system benefits include 64 times more coverage, 2.3 M sub v more sensitivity, and a factor of eight improvement in satellite velocity coverage. GRA

N76-21418# Naval Electronics Lab. Center, San Diego, Calif.
ANALYSIS OF ARRAYS ON A CONDUCTING CONICAL SURFACE Research and Development Report, Jul. 1974 - Jun. 1975
G. V. Vaughn 30 Jun. 1975 27 p refs
(AD-A014593; NELC-TR-1958) Avail: NTIS CSCL 09/5

Use of the Geometrical Theory of Diffraction (GTD) to successfully calculate mutual coupling and array element patterns of an open-ended waveguide element flush-mounted on a conical surface is reported upon and sum and difference patterns, including cross-polarization field components for the slot on a conical surface array, are presented. GRA

N76-21419# Naval Research Lab., Washington, D.C.
FREQUENCY RESPONSE OF A SEGMENTED DELAY LINE MATCHED FILTER Final Report
A. F. Thornhill May 1975 22 p refs
(AD-A017861; NRL-MR-3052) Avail: NTIS CSCL 09/5

A filter matched to a phase shift keyed signal can be made with a tapped analog delay line by combining the outputs of the taps in accordance with the modulation pattern it is desired to match. If the signal duration or bandwidth is greater than delay line technology can accommodate, an equivalent matched filter can be made from several delay lines suitably interconnected. GRA

N76-21420# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
USING SIX-PORT AND EIGHT-PORT JUNCTIONS TO MEASURE ACTIVE AND PASSIVE CIRCUIT PARAMETERS
Cletus A. Hoer Sep. 1975 32 p refs
(PB-246934/4; NBS-TN-673) Avail: NTIS HC $4.00 CSCL 14B

Methods for measuring voltage, current, power, impedance, and phase angle using only amplitude type detectors are reviewed. Vector voltmeters and reflectometers can be constructed to measure all of these quantities in terms of four amplitude measurements made on four arms of a six-port junction. Whereas previous uses of this type of instrument depended on precision components for accuracy, new equations switch this dependence primarily to detector linearity and only secondarily on the properties of the measuring device itself. GRA

N76-21421# I-T-E Imperial Corp., Greensburg, Pa. Power Equipment Group.
OPTIMIZED DESIGN FOR GAS CABLE SYSTEMS Final Report
John C. Cronin Sep. 1975 225 p refs Sponsored in part by Electric Power Res. Inst.
(Contract E(49-18)-1615)
(PB-247677/8; EPRI-7825-FR) Avail: NTIS HC $7.75 CSCL 09A

Single conductor and three conductor designs were evaluated, and aboveground and underground installation modes were considered. Designs were compared on the basis of energy transportation costs, and it was found that significant economies were realized at the higher voltages. It was concluded that gas-insulated systems were completely acceptable, and that the aboveground mode was the most cost effective. Enclosure development focussed on spiral welding was studied and an analysis was made of thin wall corrugated enclosures. Conductor joining focussed on developing a copper to aluminum inertia welded transition element, a statistical approach to the design of insulating systems, the behavior of conducting particles in a coaxial system, and insulating materials. GRA

N76-21422# I-T-E Imperial Corp., Greensburg, Pa. Power Equipment Group.
GUIDE TO THE USE OF GAS CABLE SYSTEMS
John C. Cronin and R. Dethlefsen Sep. 1975 134 p refs Sponsored in part by Electric Power Res. Inst.
(Contract E(49-18)-1615)
(PB-247898/0; EPRI-7825-TR) Avail: NTIS HC $6.00 CSCL 09A

The guide provides the utility systems designer with the basis for selection and specifying gas-insulated transmission systems. Included is a quick reference to economic application in terms of voltage, power level, and transmission distance. Also ampacities are tabulated with correction factors for a wide range of installation parameters. Prices of standard designs are given for estimating purposes. The design criteria related to thermal, dielectric, and economic factors are summarized. A computer program for optimized design of gas-insulated transmission lines was developed into a practical tool. The procedures for installation, testing, operation, and repair are described in detail. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N76-21423*+ New Mexico Univ., Albuquerque. Technology Application Center.
HEAT PIPE TECHNOLOGY: A BIBLIOGRAPHY WITH ABSTRACTS Quarterly Update, 30 Jun. 1975
30 Jun. 1975 66 p Sponsored by NASA
(NASA-CR-146640) Avail: NTIS for foreign requesters only. Domestic orders, Univ. of New Mexico, Tech. Application Center, Albuquerque Available by subscription only HC $48.00 CSCL 20M

A bibliography on heat pipe technology with abstracts of references identified during April, May, and June of 1975 was presented. The following subjects were included: (1) general information, reviews, surveys, (2) heat pipe applications, (3) heat pipe theory, (4) design, development and fabrication, (5) testing and operation, and (6) heat pipe related patents. Indices are also included. Y.J.A.

N76-21424 Engineering Sciences Data Unit, London (England).
PERFORMANCE OF CIRCULAR ANNULAR DIFFUSERS IN INCOMPRESSIBLE FLOW
Oct. 1975 27 p
(ESDU-75026) For information on availability of series, sub-series and other individual data items, write NTIS, Atten: ESDU, Springfield, Va. 22161. HC $290.50

The report further extends ESDU's coverage of diffuser performance to include annular geometries. Several basic geometries are covered in detail and application of these data to other geometries is discussed. Information on static-pressure recovery, total-pressure loss and overall flow pattern for a range of diffuser lengths, area ratios and wall angles are given and allowance is made for the effects of inlet duct radius ratio. The

data are presented for diffusers with fully-developed entry flow and free discharge or annular tailpipe exit conditions but general guidance on the effects of developing inlet flows and proximity of other ductwork components is also given. ESDU

N76-21425*# Michigan State Univ., East Lansing. Dept. of Mechanical Engineering
MEAN FLOW CHARACTERISTICS FOR THE OBLIQUE IMPINGEMENT OF AN AXISYMMETRIC JET
J. F. Foss and S. J. Kleis (Houston Univ., Tex.) 4 Aug. 1975 39 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in June 1976
(Grant NGR-23-004-068)
(NASA-CR-146856) Avail: NTIS HC $4.00 CSCL 20D

The oblique impingement of an axisymmetric jet has been investigated. A summary of the data and the analytical interpretations of the dominant mechanisms which influence the flow are reported. The major characteristics of the shallow angle oblique jet impingement flow field are: (1) minimal dynamic spreading as revealed by the surface pressure field, (2) pronounced kinematic spreading as revealed by the jet flow velocity field, (3) a pronounced upstream shift of the stagnation point from the maximum pressure point, (4) the production of streamwise vorticity by the impingement process. Author

N76-21426*# Vought Corp., Dallas, Tex. Systems Div.
DEVELOPMENT OF A SELF-CONTAINED HEAT REJECTION MODULE (SHRM), PHASE 1 Final Report
M. L. Fleming 9 Feb. 1976 259 p refs
(Contract NAS9-13533)
(NASA-CR-147514; T211-RP-028) Avail: NTIS HC $9.00 CSCL 20D

The laboratory prototype test hardware and testing of the Self-Contained Heat Rejection Module are discussed. The purpose of the test was to provide operational and design experience for application to a flight prototype design. It also provided test evaluation of several of the actual components which were to be used in the flight prototype hardware. Several changes were made in the flight prototype design due to these tests including simpler line routing, relocation of remote operated valves to a position upstream of the expansion valves, and shock mounting of the compressor. The concept of heat rejection control by compressor speed reduction was verified and the liquid receiver, accumulator, remote control valves, oil separator and power source were demonstrated as acceptable. A procedure for mode changes between pumped fluid and vapor compression was developed. Author

N76-21427*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A THEORETICAL STUDY OF THE ACOUSTIC IMPEDANCE OF ORIFICES IN THE PRESENCE OF A STEADY GRAZING FLOW
Edward J. Rice 1976 23 p refs Presented at 91st Meeting of the Acoustical Soc. of Am., Washington, D. C., 5-9 Apr. 1976
(NASA-TM-X-71903; G-8692) Avail: NTIS HC $3.50 CSCL 20D

An analysis of the oscillatory fluid flow in the vicinity of a circular orifice with a steady grazing flow is presented. The study is similar to that of Hersh and Rogers but with the addition of the grazing flow. Starting from the momentum and continuity equations, a considerably simplified system of partial differential equations is developed with the assumption that the flow can be described by an oscillatory motion superimposed upon the known steady flow. The equations are seen to be linear in the region where the grazing flow effects are dominant, and a solution and the resulting orifice impedance are presented for this region. The nonlinearity appears to be unimportant for the usual conditions found in aircraft noise suppressors. Some preliminary conclusions of the study are that orifice resistance is directly proportional to grazing flow velocity (known previously from experimental data) and that the orifice inductive (mass reactance) end correction is not a function of grazing flow. This latter conclusion is contrary to the widely held notion that grazing flow removes the effect of the orifice inductive end correction. This conclusion also implies that the experimentally observed total inductance reduction with grazing flow might be in the flow within the orifice rather than in the end correction. Author

N76-21428*# Scientific Translation Service, Santa Barbara, Calif.
MEASUREMENTS OF THE VELOCITY PROFILES OF TURBULENT SUPERSONIC BOUNDARY LAYERS WITH A LASER-DOPPLER VELOCIMETER IN COMPARISON WITH THE RESULTS OBTAINED BY A PRESSURE-TEMPERATURE PROBE
F. Maurer and J. C. Peterson Washington NASA Apr. 1976 15 p refs Transl. into ENGLISH from Rheinisch-Westfael. Tech. Hochshule, Aerodynamisches Inst., Abhandl. (West Ger.), no. 22, 1975 p 254-259
(Contract NASw-2791)
(NASA-TT-F-16984) Avail: NTIS HC $3.50 CSCL 20D

The practical applications of a laser anemometer are determined. The measurement results are described, and it is concluded that laser anemometry is an important aid in experimentation in fluid mechanics up to high supersonic Mach numbers. Author

N76-21429*# University of Southern Calif., Los Angeles. School of Engineering.
SHEAR LAYER STRUCTURE OF A LOW SPEED JET Ph.D. Thesis. Final Report, 28 Jun. 1974 - 31 Dec. 1975
Robert Allen Petersen Feb. 1976 171 p refs
(Grant NsG-3025)
(NASA-CR-146810; USC-53-4514-8122) Avail: NTIS HC $6.75 CSCL 20D

A series of measurements of near field pressures and turbulent velocity fluctuations were made in a low speed jet with a Reynolds number near 50,000 in order to investigate more quantitatively the character and behavior of the large scale structures and their interactions with each other. The near field measurements were modelled according to the vortex pairing hypothesis to deduce the distribution of pairings along the jet axis and the variances about the mean locations. The hodograph plane description of turbulence was explored in some detail, and a complex correlation quantity was synthesized which has useful properties for turbulence in the presence of mean shear. Author

N76-21430# Advisory Group for Aerospace Research and Development, Paris (France).
FLUIDICS TECHNOLOGY
J. M. Kirshner, ed. (Harry Diamond Labs., Adelphi, Md.) Jan. 1976 592 p refs
(AGARD-AG-215; AGARDograph-215) Avail: NTIS HC $13.75

This AGARDograph is based on material presented at a symposium on fluidics held by the Harry Diamond Laboratories of the United States Army. It largely represents a selection of material from the proceedings of this symposium, edited in the interests of a wider audience. The compilation is an overview in concise form of the present state of research, technology and applications of fluidics. An opening section on sensors is followed by sections on circuit components, systems and signal aspects, and design and application. A final section is concerned with research and fabrication needs in the future. The table of contents of the original HDL Symposium is appended. For individual titles, see N76-21431 through N76-21448.

N76-21431 Picatinny Arsenal, Dover, N.J.
FLUIDIC SENSORS: A SURVEY c35
Albertus E. Schmidlin and Joseph M. Kirshner (Harry Diamond Labs.) *In* AGARD Fluidics Technol. Jan. 1976 p 3-82 refs (For availability see N76-21430 12-34)

Types of fluidic sensors and the phenomena that make them possible are discussed. Various kinds of proximity sensors, force sensors, velocity sensors, position sensors, angular rate sensors, accelerometers, level sensors, temperature sensors, and concentration sensors are included. Author

N76-21432 Massachusetts Inst. of Tech., Cambridge.
A REVIEW OF VORTEX DIODE AND TRIODE STATIC AND DYNAMIC DESIGN TECHNIQUES c35
D. N. Wormley *In* AGARD Fluidics Technol. Jan. 1976 p 83-112 refs (For availability see N76-21430 12-34)

Vortex diode and triode amplifiers and their operating characteristics are described. Experimental and analytical studies of the essential characteristics of vortex chamber flow fields are briefly reviewed. Data and design techniques developed for the static design of diodes and triodes are summarized, and methods to estimate the small signal and global dynamic response of diodes and triodes are reviewed. Studies describing the application of vortex diodes and triode amplifiers in engineering systems are cited. Author

N76-21433 State Univ. of New York, Buffalo. Dept. of Mechanical Engineering.
THE TURBULENCE AMPLIFIER: STATIC AND DYNAMIC CHARACTERISTICS **c35**
Adam C. Bell *In* AGARD Fluidics Technol. Jan. 1976 p 113-156 refs (For availability see N76-21430 12-34)

The transition from laminar to turbulent flow in jets is discussed along with the advantages and disadvantages of the turbulence amplifiers (TA). The static performance, design parameters, analysis for jet and tube flow are also discussed for TA. F.O.S.

N76-21434 Harry Diamond Labs., Adelphi, Md.
ANALYTIC DESIGN OF LAMINAR PROPORTIONAL AMPLIFIERS **c35**
Francis M. Manion and Tadeusz M. Drzewiecki *In* AGARD Fluidics Technol. Jan. 1976 p 157-207 refs (For availability see N76-21430 12-34)

The analytic design of laminar proportional amplifiers is discussed. After a historical review of analog fluidic devices, the advantages of and rationale for using laminar devices are shown. Among some of the more desirable features of laminar devices are the improvements obtained in gain, dynamic range and signal-to-noise ratio, not to mention the ease of scaling. A general geometric configuration for laminar proportional (analog) amplifiers is presented that considers control and output-port width, splitter-to-nozzle distance, splitter thickness, aspect ratio, and spacing between downstream edges of the control ports normalized to the supply nozzle width as the parameters of concern in design. The approach geometry, such as the supply, control, output and vent lines, is treated in terms of known viscous impedance variables. Staging techniques are presented also. Author

N76-21435* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL DESIGN OF LAMINAR PROPORTIONAL AMPLIFIERS **c35**
R. F. Hellbaum *In* AGARD Fluidics Technol. Jan. 1976 p 209-227 refs (For availability see N76-21430 12-34)

An experimental program was initiated at Langley Research Center to study the effects of various parameters on the design of laminar proportional beam deflection amplifiers. Matching and staging of amplifiers to obtain high-pressure gain was also studied. Variable parameters were aspect ratio, setback, control length, receiver distance, receiver width, width of center vent, and bias pressure levels. Usable pressure gains from 4 to 19 per stage can now be achieved, and five amplifiers were staged together to yield pressure gains up to 2,000,000. Author

N76-21436 Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Mechanical Engineering.
THE EFFECT OF GEOMETRIC AND FLUID PARAMETERS ON STATIC PERFORMANCE OF WALL-ATTACHMENT-TYPE FLUID AMPLIFIERS **c35**
H. L. Moses and R. A. Comparin (Newark Coll. of Eng.) *In* AGARD Fluidics Technol. Jan. 1976 p 229-248 refs (For availability see N76-21430 12-34)

The current state-of-the-art in relating the geometry and fluid parameters to the static performance characteristics of wall-attachment-type fluid amplifiers is reviewed. The basic concepts involved in available analytical approaches are outlined with some experimental results. The effect of these parameters on amplifier performance is summarized, with reference to the analyses and experiments. Author

N76-21437 Harry Diamond Labs., Adelphi, Md.
THE DESIGN OF FLUERIC, TURBULENT, WALL ATTACHMENT FLIP-FLOPS **c35**
Tadeusz M. Drzewiecki *In* AGARD Fluidics Technol. Jan. 1976 p 249-290 refs (For availability see N76-21430 12-34)

A guide is presented for the design of turbulent, wall attachment flip-flops with straight walls and sharp splitters. The analysis provides the steady state and transient characteristics, and the results are presented graphically to facilitate design. Fabrication techniques are discussed where they may compromise design criteria. A specific design for minimum response time is followed from conception to final component status. In addition a typical design problem is considered and solved. Author

N76-21438 Surrey Univ., Guildford (England). Dept. of Mechanical Engineering.
DIGITAL FLUIDIC COMPONENT AND SYSTEM DESIGN
G. A. Parker *In* AGARD Fluidics Technol. Jan. 1976 p 293-316 refs (For availability see N76-21430 12-34)

Moving part and nonmoving part digital fluid devices are discussed. Digital component characteristics, digital modules, sensors, combinational, and sequential circuit design are described. F.O.S.

N76-21439 Fachhochschule, Cologne (West Germany).
SIGNAL ANALYSIS OF FLUIDIC NETWORKS
H. M. Schaedel *In* AGARD Fluidics Technol. Jan. 1976 p 317-388 refs (For availability see N76-21430 12-34)

The problems of signal processing in fluidic networks are compared to those in electrical communication. Topics discussed include: the electric-fluidic analogy, turbulent resistance, transmission lines, ac-circuits, and pulses in fluidic networks. F.O.S.

N76-21440 Lehigh Univ., Bethlehem, Pa.
ANALOG FLUIDIC CIRCUITRY: REVIEW, CRITIQUE AND A NEW OPERATIONAL AMPLIFIER
Forbes T. Brown *In* AGARD Fluidics Technol. Jan. 1976 p 389-407 refs (For availability see N76-21430 12-34)

Two different approaches to analog fluidic circuitry are found in the literature. The first utilizes high gain amplifiers with feedback (operational amplifiers) to achieve easy design, excellent linearity, low noise and low sensitivity to disturbances at a cost of limited bandwidth, high power consumption and high expense. The second utilizes fewer amplifiers with feed-forward and a minimum of feedback to achieve the opposite consequences. An operational amplifier is proposed which, through resonance tubes placed in the forward loop upstream of the gain block, has a greatly extended bandwidth at a cost of increased sensitivity to load changes at high frequencies. Author

N76-21441 Harry Diamond Labs., Adelphi, Md.
FLUIDIC NOTCH FILTERS
Gary L. Roffman *In* AGARD Fluid Technol. Jan. 1976 p 409-443 refs (For availability see N76-21430 12-34)

Ten notch-filter circuits with biquadratic transfer functions are described. Notch filters are used in control systems to prevent instabilities due to mechanical resonances. The electronic circuit literature was searched to find circuits with biquadratic transfer functions that could be implemented with fluidic amplifiers. The amplifiers are assumed to have equal input and output impedances, and all high-gain amplifiers used are assumed to have a pressure gain of 2,000. Using these characteristics, the frequency response of the circuits is calculated using a digital, circuit-analysis program. The best circuit, based on accuracy in producing a required transfer function for the M60A1 tank control system, gain insensitivity, and least number of compliances (bellows) requires three high-gain amplifiers. Advantages and disadvantages of all the circuits are discussed. Author

N76-21442 Harry Diamond Labs., Adelphi, Md.
CIRCUIT MODELS OF PASSIVE PNEUMATIC FLUIDIC COMPENSATION NETWORKS
Joseph M. Iseman *In* AGARD Fluidic Technol. Jan. 1976 p 445-484 refs (For availability see N76-21430 12-34)

Circuit models of passive pneumatic fluidic components are summarized, and the feasibility of a circuit approach for designing passive fluidic control system circuits is described. Starting with a set of fluidic components: capillaries, enclosed volumes, bellows modules, and diaphragm modules. Circuit models were synthesized from an analytical-experimental-computational approach. Simple,

ideal electronic circuit models that are linear and frequency independent were extended to models that are nonlinear and frequency dependent. These circuit models are described by analytic expressions. A few test configurations were built and their responses were measured. Simulation for these configurations was performed with digital computer programs. Comparisons between the test data and simulated models were made and qualitatively evaluated; these data are generally in agreement over the ranges tested. Author

N76-21443 Harry Diamond Labs., Adelphi, Md.
FLUIDIC STANDARDIZATION EFFORTS
R. Pierce Trask, II *In* AGARD Fluidics Technol. Jan. 1976 p 487-496 (For availability see N76-21430 12-34)

Fluidic standards are discussed with respect to their development, subject material, use within the fluidic technology, and to some extent their relationship to other technologies. The many groups that are active in developing standards and the standard documents they issue are described. Among the most active groups are the Government Fluidics Coordination Group (GFCG) and the National Fluid Power Association (NFPA). Two military standards on fluidic terminology, symbology, and test methods, were developed and recently revised by the GFCG. Two additional standards on moving-part fluid-logic symbols and data presentation were developed by the NFPA. These four documents form the framework of the current fluidic standards used in the United States. Author

N76-21444 Harry Diamond Labs., Washington, D.C.
MILITARY APPLICATIONS IN FLUIDICS
R. N. Gottron and L. S. Cox *In* AGARD Fluidics Technol. Jan. 1976 p 497-510 refs (For availability see N76-21430 12-34)

U.S. Government programs in fluidics are discussed with brief descriptions of current system applications along with present government efforts in fabrication and reliability. Author

N76-21445 AiResearch Mfg. Co., Phoenix, Ariz.
AEROSPACE FLUIDICS APPLICATIONS AND CIRCUIT MANUFACTURE
T. G. Sutton, Sr. and W. J. Anderson *In* AGARD Fluidics Technol. Jan. 1976 p 511-536 (For availability see N76-21430 12-34)

The application of fluidics to the solution of aerospace control problems began at AiResearch in 1964. Several development programs have resulted in production applications related to the major AiResearch product lines which include gas turbines, propulsion engines, air motors, and environmental control systems. Early in these development programs, it was realized that the manufacture of monolithic flueric circuits would be necessary for aerospace use of this new technology. Research and investigation of production processes resulted in the use of photo-chemical machining and assisted diffusion bonding for manufacture of production and development fluidic circuitry. The use of these processes has led to the successful application of fluidics to aerospace products. Author

N76-21446 Sheffield Univ. (England). Dept. of Chemical Engineering.
FLOW CONTROL CIRCUITS FOR TOXIC FLUIDS
J. R. Tippetts, N. Syred, J. Grant (United Kingdom Atomic Energy Authority, Risley), and R. E. Strong (Brit. Nucl. Fuels) *In* AGARD Fluidics Technol. Jan. 1976 p 537-566 refs (For availability see N76-21430 12-34)

Classical and newly-developed fluidic devices which are being used to handle active fluids in a nuclear fuel processing plant are described. Author

N76-21447 Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology.
DEVELOPMENT NEEDS
J. R. Tippetts *In* AGARD Fluidics Technol. Jan. 1976 p 567-582 refs (For availability see N76-21430 12-34)

The importance of development as a rational process is emphasized. Scope for future development with a reasonable prospect of pay-off is discussed. It is shown that the general field of flow control is worthy of intensive development. Numerous useful applications for fluidic techniques exist in chemical and nuclear plans. Some useful circuits are suggested; the development needs are self-evident. The many diverse flow control elements are interrelated by the indefinite circle diagram. This results in the identification of certain desirable properties which may guide the future development of devices and circuits. Author

N76-21448 Harry Diamond Labs., Adelphi, Md.
FABRICATION REQUIREMENTS IN FLUIDICS TECHNOLOGY
Lyndon S. Cox *In* AGARD Fluidics Technol. Jan. 1976 p 583-593 refs (For availability see N76-21430 12-34)

The relationship between the manufacturing processes and the successful fabrication of a fluidic item for a specific use is discussed. The fabrication process including cutting, etching, casting, electroforming, and forming are reviewed along with the problem areas. Types of applications such as switching and logic circuits, and analog circuits are presented. F.O.S.

N76-21449# National Aerospace Lab., Tokyo (Japan).
UTILITY EVALUATION OF A PROTOTYPE HYDRAULIC ANALOG LOADING SYSTEM OF PRESSURE CONTROL SYSTEM
Mitsuei Ikeya Aug. 1975 19 p refs In JAPANESE; ENGLISH summary
(NAL-TR-424) Avail: NTIS HC $3.50

The feasibility of an analog loading system utilizing a hydraulic servo valve of the pressure control type was evaluated. The results of the first study moved that the system had excellent applicability, but prototype system encountered a drawback in that the system had a relatively low frequency limit, for practical use. To investigate this problem, simulation studies on a digital computer were carried out and the results indicate a high dependency of frequency limit on the time constant of the servo valve, which is also experimentally confirmed. Based on this evaluation, it is shown that the frequency limit can be made 10Hz or higher. In addition, the results provide useful data for the fundamental design of the analog loading system. Author

N76-21450# National Aerospace Lab., Tokyo (Japan).
CONSTANT-TEMPERATURE HOT WIRE ANEMOMETER FOR MEASUREMENT OF TURBULENT FLOWS WITH STRONG INTERMITTENCY
Tadaharu Watanuki Aug. 1975 24 p refs In JAPANESE; ENGLISH summary
(NAL-TR-420) Avail: NTIS HC $3.50

A constant temperature hot-wire anemometer system with the long term signal integrators is developed by applying integrated circuit modules. The system is designed for use in turbulent flows with strong intermittency. The anemometer output and its square are integrated for a reasonably long period of the order of several tens of seconds to produce the mean as well as the mean-square of the anemometer output. From these results mean velocities and true root-mean-square velocity fluctuations of turbulent flows are obtained. The anemometer response to square-wave voltage inputs is analyzed and formula which predicts the hot-wire frequency response to fluctuating flows is worked out. The integrators are calibrated for both dc and ac inputs. As an example of turbulence measurements, the transitional boundary layer developed along a test section side wall of the smoke-wind tunnel is surveyed. The results are in fair agreement with the published results for transitional boundary layer along flat plates. Author

N76-21451# National Aerospace Lab., Tokyo (Japan).
HYDRAULIC ANALOG LOADING SYSTEM EXPERIMENTAL STUDY
Mitsuei Ikeya Aug. 1975 26 p refs In JAPANESE; ENGLISH summary
(NAL-TR-422) Avail: NTIS HC $4.00

The concept of an analog loading system utilizing an active element was developed. This system is capable of generating a loading effect as a function of displacement, and its first and second derivatives with arbitrary coefficients. Based upon this concept, actual hardware was developed consisting of electric elements and a hydraulic servomechanism of the pressure control type with a large underlap servo valve (prototype model). Experiments were carried out by driving the system externally to obtain the static and dynamic characteristics. The results show

that the system possesses adequate analog loading effect to an upper frequency limit, and that it provides a powerful tool for practical use. Author

N76-21452*# Bell Aerospace Co., Buffalo, N.Y.
MODELING OF THREE-DIMENSIONAL MIXING AND REACTING DUCTED FLOWS Final Report
S. W. Zelazny, A. J. Baker, and W. L. Rushmore Washington NASA Apr. 1976 100 p refs
(Contract NAS1-13165)
(NASA-CR-2661) Avail: NTIS HC $5.00 CSCL 20D

A computer code, based upon a finite element solution algorithm, was developed to solve the governing equations for three-dimensional, reacting boundary region, and constant area ducted flow fields. Effective diffusion coefficients are employed to allow analyses of turbulent, transitional or laminar flows. The code was used to investigate mixing and reacting hydrogen jets injected from multiple orifices, transverse and parallel to a supersonic air stream. Computational results provide a three-dimensional description of velocity, temperature, and species-concentration fields downstream of injection. Experimental data for eight cases covering different injection conditions and geometries were modeled using mixing length theory (MLT). These results were used as a baseline for examining the relative merits of other mixing models. Calculations were made using a two-equation turbulence model (k+d) and comparisons were made between experiment and mixing length theory predictions. The k+d model shows only a slight improvement in predictive capability over MLT. Results of an examination of the effect of tensorial transport coefficients on mass and momentum field distribution are also presented. Solutions demonstrating the ability of the code to model ducted flows and parallel strut injection are presented and discussed. Author

N76-21453*# Avco Systems Div., Wilmington, Mass.
THE NATA CODE; THEORY AND ANALYSIS. VOLUME 2: USER'S MANUAL Final Report
W. L. Bade and J. M. Yos 1975 302 p refs
(Contract NAS9-9744)
(NASA-CR-141743; AVSD-0068-75-CR-Vol-2) Avail: NTIS HC $9.75 CSCL 20D

The NATA code is a computer program for calculating quasi-one-dimensional gas flow in axisymmetric nozzles and rectangular channels, primarily to describe conditions in electric archeated wind tunnels. The program provides solutions based on frozen chemistry, chemical equilibrium, and nonequilibrium flow with finite reaction rates. The shear and heat flux on the nozzle wall are calculated and boundary layer displacement effects on the inviscid flow are taken into account. The program contains compiled-in thermochemical, chemical kinetic and transport cross section data for high-temperature air, CO2-N2-Ar mixtures, helium, and argon. It calculates stagnation conditions on axisymmetric or two-dimensional models and conditions on the flat surface of a blunt wedge. Included in the report are: definitions of the inputs and outputs; precoded data on gas models, reactions, thermodynamic and transport properties of species, and nozzle geometries; explanations of diagnostic outputs and code abort conditions; test problems; and a user's manual for an auxiliary program (NOZFIT) used to set up analytical curvefits to nozzle profiles. Author

N76-21454*# Thermo Mechanical Systems Co., Canoga Park, Calif.
DEVELOPMENT OF AN EFFICIENT COMPUTER CODE TO SOLVE THE TIME-DEPENDENT NAVIER-STOKES EQUATIONS Final Report
James L. Harp, Jr. and Thomas P. Oatway Dec. 1975 18 p refs
(Contract NAS2-8471)
(NASA-CR-137851; SR-26) Avail: NTIS HC $3.50 CSCL 20D

A research effort was conducted with the goal of reducing computer time of a Navier Stokes Computer Code for prediction of viscous flow fields about lifting bodies. A two-dimensional, time-dependent, laminar, transonic computer code (STOKES) was modified to incorporate a non-uniform timestep procedure. The non-uniform time-step requires updating of a zone only as often as required by its own stability criteria or that of its immediate neighbors. In the uniform timestep scheme each zone is updated as often as required by the least stable zone of the finite difference mesh. Because of less frequent update of program variables it was expected that the nonuniform timestep would result in a reduction of execution time by a factor of five to ten. Available funding was exhausted prior to successful demonstration of the benefits to be derived from the non-uniform time-step method. Author

N76-21455*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EVALUATION OF MEAN AND TURBULENT VELOCITY MEASUREMENTS IN SUBSONIC ACCELERATED BOUNDARY LAYERS
V. A. Sandborn (Colorado State Univ.) and H. L. Seegmiller Mar. 1976 43 p refs
(NASA-TM-X-62488; A-6278) Avail: NTIS HC $4.00 CSCL 20D

Exploratory measurements of the mean and turbulent flow in the wall boundary layer of a 15.5- by 10.2-cm channel were obtained as part of an instrumentation development program for measurements in compressible flow. Mean surface and flow-field surveys were obtained at channel Mach numbers ranging from 0.2 to 0.9. The mean velocity distributions were obtained with total pressure probes and a laser velocimeter. At a channel Mach number of 0.2, several types of hot-wire probes were used to obtain both velocity fluctuations and Reynolds shear-stress results. Author

N76-21456*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SHOCK INTERFERENCE HEAT TRANSFER TO TANK CONFIGURATIONS MATED TO A STRAIGHT-WING SPACE SHUTTLE ORBITER AT MACH NUMBER 10.3
Davis H. Crawford Washington Apr. 1976 50 p refs
(NASA-TN-D-8203; L-10441) Avail: NTIS HC $4.00 CSCL 20D

Heat transfer was measured on a space shuttle-tank configuration with no mated orbiter in place and with the orbiter in 10 different mated positions. The orbiter-tank combination was tested at angles of attack of 0 deg and 5 deg, at a Mach number of 10.3, and at a free-stream Reynolds number of one million based on the length of the tank. Comparison of interference heat transfer with no-interference heat transfer shows that shock interference can increase the heat transfer to the tank by two orders of magnitude along the ray adjacent to the orbiter and can cause high temperature gradients along the tank skin. The relative axial location of the two mated vehicles determined the location of the sharp peaks of extreme heating as well as their magnitude. The other control variables (the angle of attack, the gap, and the cross-section shape) had significant effects that were not as consistent or as extreme. Author

N76-21457*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AXIAL JET MIXING OF ETHANOL IN SPHERICAL CONTAINERS DURING WEIGHTLESSNESS
John C. Audelott Washington Apr. 1976 27 p refs
(NASA-TM-X-3380; E-8605) Avail: NTIS HC $4.00 CSCL 20D

An experimental program was conducted to examine the liquid flow patterns that result from the axial jet mixing of ethanol in 10-centimeter-diameter spherical containers in weightlessness. Complete liquid circulation flow patterns were easily established in containers that were less than half full of liquid, while for higher liquid fill conditions, vapor was drawn into the inlet of the simulated mixer unit. Increasing the liquid-jet or lowering the position at which the liquid jet entered the container caused increasing turbulence and bubble formation. Author

N76-21458*# Avco Systems Div., Wilmington, Mass.
THE NATA CODE; THEORY AND ANALYSIS. VOLUME 3: PROGRAMMER'S MANUAL Final Report
W. L. Bade and J. M. Yos 2 Sep. 1975 635 p refs
(Contract NAS9-9744)
(NASA-CR-141744; AVSD-0138-75-RR-Vol-3) Avail: NTIS HC $16.25 CSCL 20D

The present, third volume of the final report is a programmer's

manual for the code. It provides a listing of the FORTRAN 4 source program; a complete glossary of FORTRAN symbols; a discussion of the purpose and method of operation of each subroutine (including mathematical analyses of special algorithms); and a discussion of the operation of the code on IBM/360 and UNIVAC 1108 systems, including required control cards and the overlay structure used to accommodate the code to the limited core size of the 1108. In addition, similar information is provided to document the programming of the NOZFIT code, which is employed to set up nozzle profile curvefits for use in NATA.
Author

N76-21459*# Georgia Inst. of Tech., Atlanta.
A STUDY OF TURBULENT FLOW BETWEEN PARALLEL PLATES BY A STATISTICAL METHOD Final Report
R. Srinivasan, D. P. Giddens, L. H. Bangert, and J. C. Wu Washington NASA Apr. 1976 57 p refs
(Grants NGR-11-002-157; NGR-11-002-159)
(NASA-CR-2663) Avail: NTIS HC $4.50 CSCL 20D

Turbulent Couette flow between parallel plates was studied from a statistical mechanics approach utilizing a model equation, similar to the Boltzmann equation of kinetic theory, which was proposed by Lundgren from the velocity distribution of fluid elements. Solutions to this equation are obtained numerically, employing the discrete ordinate method and finite differences. Two types of boundary conditions on the distribution function are considered, and the results of the calculations are compared to available experimental data. The research establishes that Lundgren's equation provides a very good description of turbulence for the flow situation considered and that it offers an analytical tool for further study of more complex turbulent flows. The present work also indicates that modelling of the boundary conditions is an area where further study is required. Author

N76-21460*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ONE-DIMENSIONAL NUMERICAL ANALYSIS OF THE TRANSIENT THERMAL RESPONSE OF MULTILAYER INSULATIVE SYSTEMS
Claud M. Pittman and Kay L. Brinkley Washington Apr. 1976 46 p refs
(NASA-TM-X-3370; L-10637) Avail: NTIS HC $4.00 CSCL 20D

A one-dimensional numerical analysis of the transient thermal response of multilayer insulative systems has been developed. The analysis can determine the temperature distribution through a system consisting of from one to four layers, one of which can be an air gap. Concentrated heat sinks at any interface can be included. The computer program based on the analysis will determine the thickness of a specified layer that will satisfy a temperature limit criterion at any point in the insulative system. The program will also automatically calculate the thickness at several points on a vehicle and determine total system mass.
Author

N76-21461# Kozponti Fizikai Kutato Intezet, Budapest (Hungary).
AXIAL DISTRIBUTION OF VOID FRACTION IN SUBCOOLED BOILING
L. Maroti 1975 30 p refs
(KFKI-75-52) Avail: ERDA Depository Libraries HC $4.50

A theoretical approach to the axial distribution of liquid temperature, vapor quality, and void fraction in subcooled boiling is presented. The model is based on the temperature distribution of the thermal boundary layer which can be considered as a measure of deviation from equilibrium condition. It is shown that wall-superheat and subcooling are convenient tools for expressing the vapor generation and the condensation rate in the process. The model is compared with experimental data taken from the available literature and the agreement is found to be surprisingly good, in spite of the fact that the model does not use any empirical constant except those of the applied correlations like void, convective and boiling heat transfer correlations.
Author (NSA)

N76-21462# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
TWO-PHASE THERMAL BOUNDARY LAYERS ALONG HEATED WALLS
M. Cumo, G. E. Farello, G. Ferrari, G. Nozzi, and M. Montanari 1975 45 p refs
(RT/ING-(75)6) AVAIL: ERDA Depository Libraries HC $5.25

An exponential trend was found of the overall boundary layer thickness with length along the heated strip. Flowrate and pressure influences on the thickness of boundary layer appear to be rather weak.
Author (NSA)

N76-21463# Danish Atomic Energy Commission, Risoe.
EFFECT OF BOUNDARY LAYER ON THE SEPARATION DISTANCE MAGNETICALLY DRIVEN SHOCK TUBE
C. T. Chang Feb. 1975 12 p refs
(RISO-321) Avail: ERDA Depository Libraries HC $4.00

An investigation was made of the possible effect of the boundary layer on the lack of separation observed between the shock and the current sheath in a magnetically driven shock tube operating under discharge conditions of high voltage and low pressure. Since the calculated and the observed maximum displacement thickness in the pressure range investigated was around 1 mm only, it was concluded that the presence of a viscous layer at the wall cannot be of importance. Instead, the observed lack of separation is most likely due to the leakage of the compressed gas through the current-sheath, and to the diffusive nature of the driving current.
Author (NSA)

N76-21464# California Univ., Livermore. Lawrence Livermore Lab.
TRANSIENT GAS FLOW THROUGH LAYERED POROUS MEDIA
F. A. Morrison, Jr. 16 Jan. 1975 44 p Sponsored by ERDA
(Contract W-7405-eng-48)
(UCID-16692) Avail: NTIS HC $5.25

Low Reynolds number isothermal flow of an ideal gas through layered porous material was investigated analytically. Relations governing the transient flow in one dimension are obtained. An implicity, iterative, unconditionally stable finite difference scheme is developed for calculation of such flows. A computer code, SIROCCO, employing this technique has been written and implemented on the LLL computer system. A listing of the code is included. This code may be effectively applied to the evaluation of stemming plans for underground nuclear experiments.
Author (NSA)

N76-21465# Aerojet Nuclear Co., Idaho Falls, Idaho.
TRANSIENT PROPAGATION BEHAVIOR OF TWO-PHASE FLOW EQUATIONS
R. W. Lyczkowski 1975 31 p refs Presented at the Conf. on Heat Transfer, San Francisco, 11 Aug. 1975
(Conf-750804-10) Avail: NTIS HC $5.00

The capability of published two-phase flow equation sets to predict transient propagation behavior has been studied numerically. The equation sets are those cited by Wallis for separated flow and extensions of those used by Rudinger and Chang for dispersed flow. The original Rudinger-Chang set had to be modified because it can adequately describe only the transient flow of very dilute suspensions of solids in air. This numerical study shows that pressure pulses propagate at essentially the sound speeds obtained from characteristics analysis for the equation sets investigated. Comparisons of numerical results with experimental air-water pressure propagation data show that only the modified Rudinger-Chang equation set exhibits propagation behavior in good agreement with the experimental observations at low (less than 10 percent) void fractions.
Author (NSA)

N76-21466# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorbauelemente.
ANALYTICAL TREATMENT OF TWO-DIMENSIONAL HEAT CONDUCTIVITY IN A RECTANGULAR CROSS SECTION UNDER GIVEN BOUNDARY CONDITIONS
E. Achenbach and N. Iniotakis Mar. 1975 14 p In GERMAN; ENGLISH summary
(JUL-1172) Avail: ERDA Depository Libraries HC $4.00

The analytical solution is given for the two-dimensional heat conduction in a rectangular cross section. The boundary conditions are as follows: three sides of the rectangle are kept at a constant temperature whereas heat is transferred from the fourth side to a fluid. This problem arises when the local heat transfer is measured by means of a flush mounted plug thermally

insulated from the surroundings. This method was applied to determine the local heat transfer coefficient of smooth and rough surfaced heat exchangers for gas-cooled nuclear reactors.
Author (NSA)

N76-21467# Bristol Univ. (England). Dept. of Aeronautical Engineering.
AN INVESTIGATION INTO THE BEHAVIOUR OF A SOLID WATER JET AND SPRAY JET ON IMPINGEMENT AT THE EDGE OF AN INCLINED FLAT PLATE
R. J. Cawthorne and D. J. Coates Jun. 1974 66 p refs
(BU-180) Avail: NTIS HC $4.50

A two-dimensional study was undertaken and flow deflection characteristics were investigated for a variety of plate incidences from 0 to 90 deg. The effect of plate position relative to the jet was studied for each incidence. For both solid and spray jet an optimum plate incidence was found to exist providing maximum spray deflection at a given plate position. It was also discovered that for large spray deflections to result, at least three-quarters of the jet thickness needed to be intercepted by the plate. A theoretical analysis was performed for the solid jet and an empirical formula derived, relating plate position and incidence to flow deflection. This formula showed good agreement with experimental results. The data obtained should be helpful in the design of a deflector plate for the purpose of spray suppression on aircraft undercarriages. Author (ESA)

N76-21468# Bristol Univ. (England). Dept. of Aeronautical Engineering.
INVESTIGATION INTO SECONDARY FLOW IN MITRED BENDS
I. J. Lee and G. Weeks Jun. 1974 27 p refs
(BU-182) Avail: NTIS HC $4.00

The effect of different cross sections of ducting on the flow in the region of a right angle mitred bend was investigated. Ducts of circular, square, and diamond cross section were used, each of 0.05 sq m in cross sectional area. Observations were made at Reynolds Numbers of 3.83 x 100,000 and 1.85 x 100,000, with wool tufts and spinners. Turbulent regions were observed in the outer corner of each bend and in the upper part of each downstream duct extending to approximately 0.65 m downstream of the bend. This region contained a bubble of reversed flow. The main flow turbulence grew progressively downstream of the bend. A pair of contra-rotating vortices was found originating from the inside of the circular and diamond section bends which were swept downstream. No such pair was present in the rig of square cross section. The pattern of flow did not change with speed but was strongly influenced by the cross sectional shape of the ducting. This confirms a previous suggestion that vortices are produced in a mitred bend if the flow at the bend separates at a swept edge.
Author (ESA)

N76-21469# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
THE FINITE ELEMENT METHOD APPLIED TO FLUID MECHANICS
J. H. Argyris and P. C. Dunne Sep. 1974 43 p refs Presented at the Conf. on Computational Methods and Probl. in Aeron. Fluid Dyn., Manchester, Engl., 24-26 Sep. 1974
(ISD-182) Avail: NTIS HC $4.00

The origins and bases of the finite element method and some analogies such as simple membrane (soap film) analogy and a more complex plate analogy which permit existing software to be applied to fluid problems are described. Peculiar difficulties arising when applying the finite element method to the Navier-Stokes equation are highlighted. ESA

N76-21470# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Dynamik Verduennter Gase.
THE HYPERSONIC FLOW ALONG A SLENDER BODY WITH ROUNDED NOSE FOR SMALL REYNOLDS NUMBERS
Dietrich Vennemann 28 Nov. 1975 97 p refs In GERMAN; ENGLISH summary Report will also be announced as translation
(DLR-FB-75-73) Avail: NTIS HC $5.00; DFVLR, Cologne, DM 44.60

Experimental investigations were carried out for the low density flow field along a circular cylinder with a hemispherical nose. This type of flow is in the regime between continuum flow and free molecular flow. The results for the heat transfer coefficients complete former experimental results and allow a comparison with different theories for the transition regime. The experimental results on the temperature field of the vibrational and the rotational temperature, and especially of the density, which were obtained by the electron beam technique, give information on the shock strength, the distance of the shock from the body, and the intensity of the shock and their deviation from the corresponding values of continuum flow. Author (ESA)

N76-21471# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Angewandte Gasdynamik.
WALL FLOW AND HEAT TRANSFER MEASUREMENTS IN CORNER REGIONS SUBJECT TO LONGITUDINAL HYPERSONIC FLOW
Hermann-Josef Schepers 10 Dec. 1975 34 p refs In GERMAN; ENGLISH summary Report will also be announced as translation
(DLR-FB-76-02) Avail: NTIS HC $4.00; DFVLR, Cologne, DM 15.60

Flow and heat transfer measurements were carried out in a blowdown wind tunnel at a Mach number of M = 8.9 for simple corner models, consisting of two flat plates intersecting at 90 deg with different wedges in the rear section. To estimate the effects of temperature a method of contactless instationary temperature measurements was used. Results show the different influences of the complex flow field on the heat transfer distribution in the corner region at different angles of attack, wedge angles, and leading edge curvature. Author (ESA)

N76-21472# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF THE FLOW IN TURBOJET TEST CELL AUGMENTERS Ph.D. Thesis
Jack Douglas Hayes Sep. 1975 83 p refs
(AD-A018193) Avail: NTIS CSCL 21/5

A two-dimensional elliptic computer model was adapted to the solution of the flow field in a turbojet test cell section which contained the engine exhaust duct and augmenter tube. Various engine power settings, augmentation ratios, and augmenter geometries were investigated. Flow visualization and static pressure recovery were primary objectives subject to specified engine power settings and augmentation ratios. Capabilities and limitations of the model are discussed. GRA

N76-21473# Dyna East Corp., Wynnewood, Pa.
TWOFLO, A COMPUTER CODE TO SOLVE THE PROBLEM OF TWO-PHASE FLOW WITH SHOCKS IN A DUCT
Donald L. Tuckmantel and Pei Chi Chou Oct. 1975 141 p
(Contract DAAD05-74-C-0749; DA Proj. 1T1-61102-AH-43)
(AD-A018009; BRL-CR-265) Avail: NTIS CSCL 19/4

This report treats the problem of two phase flow with shocks in a duct using a numerical procedure involving both method of characteristics and finite difference techniques. The formulation incorporates the conservation equations of both the particle and gas phases. The computer code TWOFLO developed to solve this problem is presented. Author (GRA)

N76-21474# Ballistic Research Labs., Aberdeen Proving Ground, Md.
COMPUTER PREDICTIONS FOR BLAST WAVE INDUCED FLOW IN A ROOM SHELTER Final Report
George A. Coulter and Volodimir B. Kucher Oct. 1975 329 p
(AD-A017746; BRL-MR-2544) Avail: NTIS CSCL 19/4

Computer predictions from the hydrodynamic code RIPPLE are given for the internal air flows generated in a room model, with and without an entrance baffle, when it is exposed to long duration blast waves. Flow parameters are predicted for the case of an assumed fully reflected wave. The parameters are given in both tabular and graphical form for cases where the outside over-pressures are 10 and 20 psi, before reflection. The results are applied to a full size room shelter. GRA

N76-21475# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Guidance and Control Directorate.

COMPUTATIONAL PROGRAM FOR THERMAL ANALYSIS OF FLUID CONTROL SYSTEMS
Paul L. Jacobs 25 Jun. 1975 16 p refs
(AD-A017758; RG-75-45) Avail: NTIS CSCL 16/4

This report describes an analysis and computer program for calculating heat transfer in a series of tube and orifice combinations in fluid control systems. Use of this program will enable an engineer to quickly determine proper tube sizing, necessary insulation, heat transfer in stagnation regions, etc., and gas temperatures at various points for typical gases used in control systems. The program is sufficiently general to allow lumped modeling of fittings, manifolds, regulators, etc., as thermal masses using the generalized orifices. GRA

N76-21476# Wisconsin Univ., Madison. Mathematics Research Center.
THE NON-MONOTONICITY OF SOLUTIONS IN SWIRLING FLOW
J. B. McLeod and S. V. Parter Oct. 1975 41 p refs
(Contract DAAG29-75-C-0024)
(AD-A017963; MRC-TSR-1551) Avail: NTIS CSCL 20/4

The existence of solutions of Batchelor's nonlinear differential equations for swirling flow induced by two parallel rotating coaxial discs of infinite size is investigated. It is found that if the discs rotate in the same direction (with one rotating and one stationary disc as a special case), then for sufficiently small kinematic viscosity of the fluid, the angular velocity of the swirling flow cannot vary monotonically in the axial direction. Should a condition of monotonic variation of the angular velocity be imposed, then a solution to the governing differential equations would not exist. A detailed step by step proof is provided. GRA

N76-21477# Duvvuri Research Associates, Chula Vista, Calif.
THEORETICAL STUDY OF TURBULENT MIXING IN INCLINED DUCTED JETS Final Report, 21 May 1973 - 31 Mar. 1975
Tirumalesa Duvvuri, Boray S. Raghunath, and Joel T. Park Jun. 1975 210 p refs
(Contract F33615-73-C-4120; AF Proj. 7116)
(AD-A017855; DRA-TR-75-03; ARL-TR-75-0223) Avail: NTIS CSCL 20/4

The problem of the inclined plane incompressible ducted turbulent jet mixing with a jet injected into an inclined duct has been analysed using the curvilinear system of coordinates. This system is chosen because of the curved flow field in the initial mixing regions and the existence of similarity solutions when analysed in the orthogonal curvilinear coordinate system referred to the jet centerline. Integral techniques and the similarity solutions have been utilized to reduce the flow field to a quasi two-dimensional flow field. Appropriate differential equations have been developed for the various types of flow regions. A generalized method for predicting the induced secondary flow is presented. GRA

N76-21478# Stanford Univ., Calif. Dept. of Applied Mechanics.
PROPAGATION OF A SHOCK WAVE FRONT ACROSS A CURVED FLUID-SOLID INTERFACE
Bruce Bennett and George Herrmann Aug. 1975 31 p refs
(Contract N00014-67-A-0112-0065; Grant
AF-AFOSR-2669-74; NR Proj. 064-525; AF Proj. 9782)
(AD-A017673; SU-DAM-75-7; AFOSR-75-1542TR) Avail: NTIS CSCL 20/4

Geometric optics, or the ray theory, is used to investigate the effect of pulse reflection and transmission at a curved fluid-solid interface. In particular, the problem of a plane pressure pulse, supported by an acoustic fluid, impinging on a plane symmetrical elastic body whose cross-section is delineated by circular arcs is considered. The response of the solid is determined along its center line to reflection at the back interface with another fluid. Consideration of the special case in which the fluid densities are zero indicates that special care must be exercised in dealing with the in vacuo problem, and particularly in specifying the boundary conditions in that instance. Author (GRA)

N76-21479# Wisconsin Univ., Madison. Mathematics Research Center.
A FREE BOUNDARY PROBLEM
Lawrence C. Evans Aug. 1975 87 p refs
(Contract DAAG29-75-C-0024)
(AD-A017923; MRC-TSR-1569) Avail: NTIS CSCL 20/4

A free boundary problem that generalizes slightly the equations modelling the flow of two immiscible fluids in a one-dimensional porous medium is studied. One seeks a curve s(t), representing the interface between the liquids, and a function u(x,t), representing-after a change of variables-the pressures of the fluids. GRA

N76-21480# Ohio State Univ. Research Foundation, Columbus.
INTERACTION OF ULTRA HIGH MACH NUMBER JETS Interim Report, 1 Jan. 1973 - 1 Jan. 1974
S. L. Petrie and K. D. Korkan Jul. 1974 55 p refs
(Contract F33615-73-C-4012; AF Proj. 7065)
(AD-A017740; ARL-74-0108) Avail: NTIS CSCL 20/4

An experimental and theoretical examination of the shock wave structure and flow variables in the interaction region of two high Mach number air jets was accomplished. A special wind tunnel facility was assembled to include two axisymmetric nozzles with the angle between the nozzle center lines adjustable to 5, 10, 15 deg. The experimental studies were also conducted with various jet Mach numbers, i.e., a Mach 9 primary jet impinged by a Mach 7, 9, 11 jet. A theoretical analysis was also conducted to estimate the angle of impingement and slip stream length, thereby aiding the sizing analysis required for the construction of this special test facility. GRA

N76-21481# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
LARGE STRUCTURE DYNAMICS AND ENTRAINMENT IN THE MIXING LAYER AT HIGH REYNOLDS NUMBER
Paul E. Dimotakis and Garry L. Brown Aug. 1975 62 p refs
Prepared in cooperation with Calif. Inst. of Tech., Pasadena
(Contracts N00014-75-C-1143; N00014-67-A-0094-0037;
NR Proj. 098-038)
(AD-A017875; SQUID-TR-CIT-7-PU) Avail: NTIS CSCL 20/4

Observations were made on a turbulent mixing layer in a water channel at Reynolds numbers up to 3 million. Flow visualization with dyes again revealed large coherent structures and showed their role in the entrainment process; observations of the reaction of a base and an acid indicator injected on the two sides of the layer, respectively, gave some indication of where molecular mixing occurs. Autocorrelations of streamwise velocity fluctuations, using an LDV, revealed a fundamental periodicity associated with the large structures. Some possible consequences of initial conditions and the influence of apparatus geometry are discussed. GRA

N76-21482# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HEAT AND MASS TRANSFER IN VENTURI TUBES
E. M. Kunina and M. I. Kheifets 14 Nov. 1975 13 p refs
Transl. into ENGLISH from Fiz. Aerodispersnykh Sistem (USSR), no. 5, 1971 p 132-137
(AD-A017732; FTD-ID(AS)I-2262-75) Avail: NTIS CSCL 20/4

This work gives a system of equations which enables one to describe the processes of heat and mass transfer and also the movement of droplets and of gas in Venturi tubes. GRA

N76-21483# ARO, Inc., Arnold Air Force Station, Tenn.
FLOW-FIELD STUDY ABOUT A HEMISPHERE-CYLINDER IN THE TRANSONIC AND LOW SUPERSONIC MACH NUMBER RANGE Final Report, 1 Sep. 1973 - 30 Sep. 1974
T. Hsieh AEDC Nov. 1975 60 p refs
(AD-A018157; ARO-PWT-TR-75-35; AEDC-TR-75-114;
AFATL-TR-75-132) Avail: NTIS CSCL 20/4

A theoretical and experimental study has been conducted of a flow field about a hemisphere-cylinder at zero incidence in the transonic and low supersonic Mach number range (M sub infinity 0.7 to 2.0). For M greater than or equal to 1, the method used is a combination of the time-dependent solution for the hemispherical nose portion and the method-of-characteristics solution for the cylindrical body portion. The relaxation method has been used for Mach numbers from 0.7 to 1.3. Experimental results indicate a strong interaction of the

shock and boundary layer for M approximately equal to 0.8. GRA

N76-21484# Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.
TRANSITION TO TRANSONIC FLOW IN THE FAR FIELD FOR A SUPERSONIC AIRFOIL IN A STRATIFIED ATMOSPHERE Interim Report
Georges A. Pechuzal Sep. 1975 118 p refs
(Grant AF-AFOSR-2452-73; AF Proj. 9749)
(AD-A017684; AFOSR-75-1544TR) Avail: NTIS CSCL 20/4

This paper deals with the steady frictionless, nonheat-conducting flow field of a thin airfoil in an atmosphere with a weak wind gradient. Because of this wind gradient, which is assumed to increase linearly with altitude, the flow gradually becomes transonic in the far field below the airfoil. This transition phenomenon also occurs in an atmosphere where the temperature decreases with altitude, and for certain cases of accelerating flights. In all these models, it is shown that a solution which describes both supersonic and transonic regimes can be derived by matching two expansions. The flow field in the transonic region is then calculated numerically using the method of characteristics and incorporating the appropriate shock relations. GRA

N76-21485# Cranfield Inst. of Technology (England). School of Mechanical Engineering.
AN ANALYSIS OF NON-CONSTANT AREA HEAT ADDITION DUE TO COMBUSTION IN A SUPERSONIC AIR-STREAM Interim Report, 1 Jul. 1974 - 30 Jun. 1975
Roy A. Cookson Sep. 1975 56 p refs
(Grant AF-AFOSR-2698-74; AF Proj. 9711)
(AD-A017685; AFOSR-75-1483TR) Avail: NTIS CSCL 20/4

A condition critical to the occurrence of ignition in a ducted supersonic stream has been proposed. By utilizing this concept as a further boundary condition, a new approach to the solution of the gas dynamic equations relevant to combustion in a ducted supersonic stream has been made. This approach involves the duct characteristic with which to describe the combustion process. For engineering, a duct law has been found to satisfy the system of equations; it can be considered to be the additional equation required to close the problem. The above temperature-area relationship, which established the critical Mach number at which thermal choking occurs as unity, can be used as an alternative to the Crocco pressure-area relationship which predicts a non-unity critical Mach number. GRA

N76-21486# Naval Ship Research and Development Center, Bethesda, Md.
THEORY OF VENTILATING OR CAVITATING FLOWS ABOUT SYMMETRIC SURFACE-PIERCING STRUTS
B. Yim Sep. 1975 46 p refs
(ZF42421001)
(AD-A017947; DTNSRDC-4616) Avail: NTIS CSCL 20/4

Two stable states of high-speed strut flow are considered in three dimensions under linear boundary conditions. The strut is thin, symmetric, without angle of attack, and has base-ventilation or base cavitation without side cavitation. The strut and cavity are represented by polynomial source distributions with unknown coefficients on the center plane. Coefficients of the polynomial for the cavity are obtained as solutions for integral equations of cavity source, using a least-squares method. All the singular double integrals in the present problem are integrated in closed forms by using recurrence formulas. Thus, common errors due to numerical integration of the singular integrals are avoided. Approximate cavity shape and cavity drag are obtained. Downwash is calculated at the hydrofoil plane, which is assumed to be located at the tip of and perpendicular to the strut. GRA

N76-21487# Illinois Univ., Chicago.
FINITE ELEMENT AND DIFFERENCE FORMULATIONS OF TRANSIENT FLUID-STRUCTURE PROBLEMS
T. B. Belytschko, J. M. Kennedy, and D. F. Schoeberle 1975 540 p refs Presented at the ANS Computational Methods in Nuclear Energy, Charleston, South Carolina, 15 Apr. 1975 Sponsored by ERDA
(CONF-750413-P2-Vol-2) Avail: NTIS

A finite element formulation is developed for the two dimensional problem of structural elements in a fluid environment, subjected to high, transient pressures. The emphasis is on short duration loads, so a Lagrangian description is used. The finite element equations for the hydrodynamic fluid are first derived from a conservation of energy approach: it is also indicated how the use of a weak form of the partial differential equations leads to the same form. The equations are then compared to the widely used finite difference equations as developed by Wilkins. It is shown that Wilkins' use of a contour integral to develop the difference formulas also corresponds to the development of a weak form, and that the resulting discrete equations are identical to the finite element equations, both at interior mesh points and along prescribed pressure boundaries. The major difference between the two methods appears to be a matter of form. Author (NSA)

N76-21488# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
AIR BUBBLER SYSTEMS TO SUPPRESS ICE Special Report
George D. Ashton Sep. 1974 44 p refs
(AD-A008867; CRREL-SR-210) Avail: NTIS CSCL 14/2

Two-dimensional line source air bubbler systems used to induce convective melting of the undersurface of an ice cover over a water body are analyzed and a procedure is developed for predicting the effectiveness of the systems. Various field conditions are considered and limitations to the effectiveness of the systems are pointed out. Example applications of the concepts and the procedures are illustrated in the Appendix. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N76-21489*# Woods Hole Oceanographic Institution, Mass.
EXPERIMENTAL DESIGN FOR DRIFTING BUOY LAGRANGIAN TEST
Peter M. Saunders Sep. 1975 40 p Sponsored by NASA
(NASA-CR-146817) Avail: NTIS HC $4.00 CSCL 14B

A test of instrumentation fabricated to measure the performance of a free drifting buoy as a (Lagrangian) current meter is described. Specifically it is proposed to distinguish between the trajectory of a drogued buoy and the trajectory of the water at the level of the drogue by measuring the flow relative to the drogue. Author

N76-21490*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LASER VELOCIMETRY APPLIED TO TRANSONIC AND SUPERSONIC AERODYNAMICS
D. A. Johnson, W. D. Bachalo (Natl. Res. Council), and D. Moddaress (Natl. Res. Council) Mar. 1976 14 p refs
(NASA-TM-X-73117; A-6510) Avail: NTIS HC $3.50 CSCL 14B

Measurements obtained with laser velocimetry in a Mach 2.9 separated turbulent boundary layer and in the transonic flow past a two-dimensional airfoil section are presented and compared to data realized by conventional techniques. Agreement in mean velocities was realized where the pressure measurements could be considered reliable; however, in regions of instantaneous reverse velocities, the laser results were found to be consistent with the physics of the flow whereas the pressure data were not. Streamwise turbulence intensities are also presented. In the transonic airfoil study, velocity measurements obtained immediately outside the upper surface boundary layer of a 6-inch chord NACA 64A010 airfoil are compared to edge velocities inferred from surface pressure measurements. For free-stream Mach numbers of 0.6 and 0.8, the agreement in results was very good. 'Dual scatter' optical arrangements in conjunction

with a single particle, counter-type signal processor were employed in these investigations. Author

N76-21491*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MICROPROCESSOR-BASED MULTICHANNEL FLUTTER MONITOR USING DYNAMIC STRAIN GAGE SIGNALS
Robert R. Smalley 1976 18 p Presented at Natl. Instrumentation Symp., San Diego, Calif., 25-27 May, 1976; Sponsored by the Instr. Soc. of Am.
(NASA-TM-X-71884; E-8659) Avail: NTIS HC $3.50 CSCL 14B

Two microprocessor-based multichannel monitors for monitoring strain gage signals during aerodynamic instability (flutter) testing in production type turbojet engines were described. One system monitors strain gage signals in the time domain and gives an output indication whenever the signal amplitude of any gage exceeds a pre-set alarm or abort level for that particular gage. The second system monitors the strain gage signals in the frequency domain and therefore is able to use both the amplitude and frequency information. Thus, an alarm signal is given whenever the spectral content of the strain gage signal exceeds, at any point, its corresponding amplitude vs. frequency limit profiles. Each system design is described with details on design trade-offs, hardware, software, and operating experience. Author

N76-21492# Royal Aircraft Establishment, Farnborough (England).
THE POSSIBILITIES OF USING A SCANNING ELECTRON MICROSCOPE FOR THE STUDY OF COMPOSITE MATERIALS HAVING AN ORGANIC MATRIX
J. Auvinet and J. Rouchon Dec. 1975 12 p refs Transl. into ENGLISH from the French Report AGARD-CP-163
(RAE-Lib-Trans-1874; BR50919; AGARD-CP-163) Avail: NTIS HC $3.50

The scanning electron microscope, with its large depth of field and high resolution makes possible the direct examination of fine and deeply contoured surfaces and is thus particularly suitable for the study of composite materials. The use is described of a scanning electron microscope for product quality control and the study of failure surfaces and corrosion in glass and high modulus fibre/epoxy matrix composites. Each of these facets is illustrated photographically. Author

N76-21493# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS, NO. 508
9 Apr. 1976 31 p Transl. into ENGLISH from Bulgarian and Hungarian Journals
(JPRS-67111) Avail: NTIS HC $4.00

Articles are presented concerning the development of and progress in the various theoretical and applied scientific disciplines and technical fields, the administration, structure, personnel, and research plans of leading East European scientific organizations and institutions, particularly the academies of sciences. Author

N76-21494# Lockheed Missiles and Space Co., Palo Alto, Calif.
DETERMINATION OF THE ALTITUDE AND ENERGY SCALES FOR A PHOTOMETRIC ANALYSIS OF PHOTOGRAPHS OF EARTH'S ATMOSPHERIC AUREOLE FROM SPACE
V. A. Shatalov, A. B. Sandomirskii, V. N. Sergeevich, and V. M. Stolberg [1975] 8 p refs Transl. into ENGLISH from Kosmich. Issled. (USSR), v. 13, no. 6, 1975 p 907-913
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Computational and direct methods for pinpointing the brightness altitude profile of the earth's atmospheric aureole to the absolute altitude are considered. The possibility of direct pinpointing of the profile of the atmospheric aureole by means of a photograph of the moon near the earth's day horizon is shown by a photographic experiment conducted on the Soyuz-8 spacecraft. The energy scale of the profile of the atmospheric aureole was verified by the brightness section of the lunar image. Author

N76-21495# Joint Inst. for Nuclear Research, Dubna (USSR).
SPECTROMETER FOR INVESTIGATION OF THE NEUTRON SMALL ANGLE SCATTERING BY THE TIME-OF-FLIGHT METHOD (THEORY)
I. Gladkikh, Yu. M. Ostanevich, and L. Cher 1975 16 p refs In RUSSIAN
(JINR-P3-8589) Avail: ERDA Depository Libraries HC $4.00

The expressions are obtained for the resolution, intensity and resolution function of a spectrometer for small angle scattering measurements by the time-of-flight method. The relations that optimize the spectrometer luminosity are given. It is shown that cooling of the moderator increases luminosity as T-2.5. The analytical form of the resolution function is found. NSA

N76-21496# California Univ., Berkeley. Lawrence Berkeley Lab.
APPLICATION OF A LOW ENERGY X-RAY SPECTROMETER TO ANALYSES OF SUSPENDED AIR PARTICULATE MATTER
R. D. Giauque, R. B. Garrett, L. Y. Goda, J. M. Jaklevic, and D. F. Malone 12 Sep. 1975 18 p refs Presented at the 24th Ann. Conf. on Appl. of X-Ray Analysis, Denver, 6 Aug. 1975 (Contract W-7405-eng-48)
(LBL-4402; Conf-750831-5) Avail: NTIS HC $4.00

A semiconductor detector X-ray spectrometer has been constructed for the analysis of elements in air particulate specimens. The excitation radiation is provided, either directly or indirectly, using a low power (40 watts) Ag anode X-ray tube. Less than 100 ng for most of the elements in the range Mg yields Zr, Pb are easily detected within two 1-minute counting intervals. A calibration technique for light element analysis and an experimental method which compensates for particle size effects are discussed. Author (NSA)

N76-21497# National Bureau of Standards, Washington, D.C. Fluid Meters Section.
AN IN-LINE DENSITY AND VISCOSITY SENSOR Final Report
L. O. Olsen and F. W. Ruegg Nov. 1974 21 p Sponsored in part by Navy and DOD Calibration Coord. Group
(PB-246622/5; NBSIR-74-620) Avail: NTIS HC $3.50 CSCL 14B

In-line density and viscosity sensors for liquids are developed to utilize measurements of differential pressure across a nozzle and a coiled capillary tube respectively, with known flowrates through each provided by a flow generator. Theory and principles of operation and instructions for calibration and use of the sensors are discussed, along with design consideration for the sensors and associated equipment. A calibration of the sensors demonstrated that viscosity and density each could be measured with a computed standard deviation of one percent. Viscosity was varied over the range of about 1 to 11 centistokes whereas density of the fluids used was near 0.8 g per cc. Application of similarity considerations is used to make the results applicable to other liquid densities. GRA

N76-21498# Harry Diamond Labs., Adelphi, Md.
DEVELOPMENT OF AN ULTRAWIDEBAND MAGNETIC-TAPE RECORDER, PHASE 2
Karl H. Krey, John W. Utecht, and Allison S. Hill Jun. 1975 24 p refs Sponsored by Army
(AD-A017950; HDL-TR-1712) Avail: NTIS CSCL 14/3

An ultrawideband transient recorder is being developed at the Harry Diamond Laboratories with recording specifications beyond the state of the art. The progress made during phase I is described in HDL-TR-1573. This report presents the accomplishments of phase II and concludes the efforts of this program. The phase II laboratory recording system again includes a Newell-type tape transport that now accelerates tape at a rate of 8,000 in./sq sec to a maximum speed of about 3000 in./sec. The recording heads developed for this system have either an all-ferrite core or a ferrite core with Alfesil pole tips. The flux is produced by a driven gap spacer placed between the pole faces. Signal frequencies from 100 kHz to 20 MHz, with bias frequencies of 100 MHz and above, have been recorded longitudinally for 5 to 8 sec. However, recordings with SNR of about 15 dB were possible for periods of only tens of milliseconds.

The upper frequency of zero-bias-recorded signals was 36 MHz at a tape speed of 2,800 in./sec. The recordings were reproduced on Mincom wideband recorders/reproducers at 60 and 120 in./sec. GRA

N76-21499# Air Force Academy, Colo. Frank J. Seiler Research Lab.
THE FLEXURAL RIGIDITY SENSOR: APPLICATIONS IN NON-DESTRUCTIVE TESTING Interim Report
Shigeo Okubo and Sal Monaco Oct. 1975 27 p refs
(AF Proj. 7904)
(AD-A017768; FJSRL-TR-75-0017) Avail: NTIS CSCL 14/2

The Frank J. Seiler Research Laboratory has developed a flexural rigidity sensor (FRS) that now makes it possible to measure dynamic flexural deformations of structures in the presence of large linear vibrations. Measurements of this type can be used to provide a spectral signature of a rigid member under varying loading conditions. Changes in the loading or flexural stiffness of the member can be readily identified by characteristic shifts in these spectral signatures. Using these methods, impending structural failures may be identified using the FRS. This compact device is completely portable and has a resolution of 10 to the minus 9th power radian with a flat response from dc to 50 kHz. It offers a wide and intriguing range of applications in non-destructive testing of civil engineering and aerospace structures. Author (GRA)

N76-21500# Naval Ship Research and Development Center, Bethesda, Md.
PARTICLE VELOCITY MEASUREMENT IN UNDERWATER SHOCK WAVES
John D. Gordon Aug. 1975 32 p refs
(DNA Proj. NWET-L02AAXYX971)
(AD-A017795; DTNSRDC-4338) Avail: NTIS CSCL 14/2

A meter for measuring the particle velocity of underwater shock waves is discussed. Field test apparatus used to position and orient the meter underwater is also discussed. To evaluate the meter, measurements of water particle velocity produced by shock waves from tapered and compact charges are compared with computations of velocity based on pressure measurements. It is shown that the independent measurement of water particle velocity provides a check on the calibration of the piezoelectric gages used to measure pressure. Uses of the water particle velocity meter in applications where computations of particle velocity are unreliable are also discussed. Author (GRA)

N76-21501# RCA Labs., Princeton, N.J.
CHARGE COUPLED SCANNED IR IMAGING SENSORS Semiannual Report, 1 Jul. 1974 - 30 Apr. 1975
Elliott S. Kohn 15 May 1975 49 p refs
(Contract F19628-73-C-0282; ARPA Order 2444)
(AD-A018057; PRRL-75-CR-25; AFCRL-TR-75-0284; SAR-3) Avail: NTIS CSCL 17/5

A charge-coupled imager sensitive to infrared light as far out as 3.5 micrometers has been fabricated and operated. It consists of a linear array of 64 Pd:p-Si Schottky-barrier detectors adjacent to a three-phase charge-coupled shift register. The design has a single level of metallization with gaps. A single transmission gate, when pulsed on, coupled each detector to its associated shift register gate thus reverse-biasing the detectors. The charges transferred to the shift register are then read out sequentially to produce the video signal. Operation is similar to that of a vidicon. The shift register had transfer losses as low as 0.0005 per transfer as measured with an electrical input. Visible images were sensed directly by illumination of the shift register through the gaps as well as through the unthinned substrate. Infrared images (1.1 micrometers - wavelengths - 3.5 micrometers) were sensed by the Schottky-barrier detectors illuminated through the (transparent) substrate. The two imaging modes could be easily distinguished by their spectral sensitivities as well as by their response to changes in their separate integration times. All IR measurements were made at 77 K. Uniformity was within a few percent, and objects at 110 C could be detected. A scheme for observing low-contrast, thermal scenes without requiring the charge-coupled shift register to carry the entire background signal has been implemented in the design of this chip. Operation in this mode was also demonstrated. Author (GRA)

N76-21502# National Bureau of Standards, Washington, D.C.
REPORT ON NBS DUAL MIXER TIME DIFFERENCE SYSTEM (DMTD) BUILT FOR TIME-DOMAIN MEASUREMENT ASSOCIATED WITH PHASE 1 OF GPS (GLOBAL POSITIONING SYSTEM)
David W. Allan Jan. 1976 21 p refs
(PB-247938/4; NBSIR-75-827) Avail: NTIS HC $3.50 CSCL 14B

The design, construction, and testing of a Dual Mixer Time Difference (DMTD) system are reported. The precision of time difference measurement with this system was shown to be about 0.1 picosecond and the accuracy about 10 ps; similarly, the frequency stability precision was shown to be described by (signa sub y)(tau) approximately equal to 10 to the minus 13th power/tan, 0.1s < tau < 1000 and equal to 10 to the minus 16th power at tau equal about half a day. The request for this DMTD system was for measuring the clocks that will go on board the satellites for Phase 1 of the Global Positioning System (GPS) program. The DMTD system described is the only system that can easily meet all of the time-domain measurement requirements for this program. GRA

N76-21503# British Steel Corp., Sheffield (England). Information Services.
METHOD FOR PREDICTING THE RESPONSE OF PHOTOELECTRIC DEVICES TO RADIATION FROM HOT STEEL
R. Senior 1975 15 p ref
(PB-246887/4; TB/CO/74/6) Avail: NTIS HC $3.50 CSCL 14B

A method is proposed for determining from fundamental theory the response of a cell to a radiation source at any temperature. Using the procedure outlined in this method the response of a commercial photodiode is estimated and an experiment to assess the validity of the method is described. GRA

N76-21504# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
TIME DOMAIN AUTOMATIC NETWORK ANALYZER FOR MEASUREMENT OF RF AND MICROWAVE COMPONENTS Final Report, 1 Jul. 1973 - 30 Jun. 1974
William L. Gans and James R. Andrews Sep. 1975 177 p refs
(Contract CCG-72-68)
(PB-247116/7; NBS-TN-672) Avail: NTIS HC $7.50 CSCL 14B

A new instrument for the measurement of the scattering parameters of RF and microwave components is described in detail. The instrument is the Time Domain Automatic Network Analyzer (TDANA). It uses time domain pulse measurements to obtain frequency domain parameters. The frequency range is dc to 18 GHz with a lower upper limit for large values of attenuation. The instrument consists of three major components: an ultra fast pulse generator, a broadband sampling oscilloscope, and a digital minicomputer. GRA

N76-21431 Picatinny Arsenal, Dover, N.J.
FLUIDIC SENSORS: A SURVEY
Albertus E. Schmidlin and Joseph M. Kirshner (Harry Diamond Labs.) *In* AGARD Fluidics Technol. Jan. 1976 p 3-82 refs (For availability see N76-21430 12-34)

N76-21432 Massachusetts Inst. of Tech., Cambridge.
A REVIEW OF VORTEX DIODE AND TRIODE STATIC AND DYNAMIC DESIGN TECHNIQUES
D. N. Wormley *In* AGARD Fluidics Technol. Jan. 1976 p 83-112 refs (For availability see N76-21430 12-34)

N76-21433 State Univ. of New York, Buffalo. Dept. of Mechanical Engineering.
THE TURBULENCE AMPLIFIER: STATIC AND DYNAMIC CHARACTERISTICS
Adam C. Bell *In* AGARD Fluidics Technol. Jan. 1976 p 113-156 refs (For availability see N76-21430 12-34)

N76-21434 Harry Diamond Labs., Adelphi, Md.
ANALYTIC DESIGN OF LAMINAR PROPORTIONAL AMPLIFIERS

Francis M. Manion and Tadeusz M. Drzewiecki *In* AGARD Fluidics Technol. Jan. 1976 p 157-207 refs (For availability see N76-21430 12-34)

N76-21435* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL DESIGN OF LAMINAR PROPORTIONAL AMPLIFIERS
R. F. Hellbaum *In* AGARD Fluidics Technol. Jan. 1976 p 209-227 refs (For availability see N76-21430 12-34)

N76-21436 Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Mechanical Engineering.
THE EFFECT OF GEOMETRIC AND FLUID PARAMETERS ON STATIC PERFORMANCE OF WALL-ATTACHMENT-TYPE FLUID AMPLIFIERS
H. L. Moses and R. A. Comparin (Newark Coll. of Eng.) *In* AGARD Fluidics Technol. Jan. 1976 p 229-248 refs (For availability see N76-21430 12-34)

N76-21437 Harry Diamond Labs., Adelphi, Md.
THE DESIGN OF FLUERIC, TURBULENT, WALL ATTACHMENT FLIP-FLOPS
Tadeusz M. Drzewiecki *In* AGARD Fluidics Technol. Jan. 1976 p 249-290 refs (For availability see N76-21430 12-34)

36 LASERS AND MASERS

Includes parametric amplifiers.

N76-21505*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SECOND NASA CONFERENCE ON LASER ENERGY CONVERSION
Kenneth W. Billman, ed. Washington 1976 196 p refs Conf. held at Moffett Field, Calif., 27-28 Jan. 1975
(NASA-SP-395) Avail: NTIS HC $7.00 CSCL 20E

The possible transmission of high power laser beams over long distances and their conversion to thrust, electricity, or other useful forms of energy is considered. Specific topics discussed include: laser induced chemistry; developments in photovoltaics, including modification of the Schottky barrier devices and generation of high voltage emf'sby laser radiation of piezoelectric ceramics; the thermo electronic laser energy converter and the laser plasmadynamics converters; harmonic conversion of infrared laser radiation in molecular gases; and photon engines. For individual titles, see N76-21506 through N76-21524.

N76-21506* National Aeronautics and Space Administration, Washington, D.C.
OVERVIEW OF THE NASA HIGH POWER LASER PROGRAM
Joseph G. Lundholm *In its* 2d NASA Conf. on Laser Energy Conversion 1976 p 5-9 (For availability see N76-21505 12-36)
CSCL 20E

The overall objectives of the NASA High Power Laser Program are reviewed along with their structure and center responsibilities. Present and future funding, laser power transmission in space, selected program highlights, the research and technology schedule, and the expected pace of the program are briefly considered.
J.M.S.

N76-21507* Massachusetts Inst. of Tech., Cambridge.
CONVERSION OF LASER ENERGY TO CHEMICAL ENERGY BY THE PHOTOASSISTED ELECTROLYSIS OF WATER
Mark S. Wrighton *In* NASA. Ames Res. Center 2d NASA Conf. on Laser Energy Conversion 1976 p 11-22 refs (For availability see N76-21505 12-36)
CSCL 20E

Ultraviolet irradiation of the n-type semiconductor TiO2 crystal electrode of an aqueous electrochemical cell evolves O2 at the TiO2 electrode and H2 at the Pt electrode. The gases are typically evolved in a 2:1 (H2:O2) volume ratio. The photoassisted reaction seems to require applied voltages, but values as low as 0.25 V do allow the photoassisted electrolysis to proceed. Prolonged irradiation in either acid or base evolves the gaseous products in amounts which clearly demonstrate that the reaction is catalytic with respect to the TiO2. The wavelength response of the TiO2 and the correlation of product yield and current are reported. The results support the claim that TiO2 is a true photoassistance agent for the electrolysis of water. Minimum optical storage efficiencies of the order of 1 percent can be achieved by the production of H2.
Author

N76-21508* Princeton Univ., N.J.
PHOTOCATALYTIC GENERATION OF HYDROGEN FROM WATER c25
William R. Bottoms and Richard B. Miles *In* NASA. Ames Res. Center 2d NASA Conf. on Laser Energy Conversion 1976 p 23-37 refs (For availability see N76-21505 12-36)
CSCL 07D

A concept designed to overcome the problems encountered when using photodissociation for the generation of hydrogen is discussed. The problems limiting the efficiency of photodissociation of water are the separation of the photolysis products and the high energy photons necessary for the reaction. It is shown that the dissociation energy of a large number of molecules is catalytically reduced when these molecules are in intimate contact with the surface of certain metals. It is proposed to develop a surface which will take advantage of this catalytic shift in dissociation energies to reduce the photon energy required to produce hydrogen. This same catalytic surface can be used to separate the reaction products if it is made so that one of the dissociations products is soluble in the metal and others are not. This condition is met by many metal systems such as platinum group metals which have been used commercially to separate hydrogen from other gases and liquids.
Author

N76-21509* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PHOTOVOLTAIC CONVERSION OF LASER ENERGY
Richard J. Stirn *In* NASA. Ames Res. Center 2d NASA Conf. on Laser Energy Conversion 1976 p 39-48 refs (For availability see N76-21505 12-36)
(Contract NAS7-100)
CSCL 20E

The Schottky barrier photovoltaic converter is suggested as an alternative to the p/n junction photovoltaic devices for the conversion of laser energy to electrical energy. The structure, current, output, and voltage output of the Schottky device are summarized. The more advanced concepts of the multilayer Schottky barrier cell and the AMOS solar cell are briefly considered.
J.M.S.

N76-21510* Harry Diamond Labs., Adelphi, Md.
HIGH PHOTOVOLTAGES IN FERROELECTRIC CERAMICS c24
Philip S. Brody *In* NASA. Ames Res. Center 2d NASA Conf. on Laser Energy Conversion 1976 p 49-59 refs (For availability see N76-21505 12-36)
CSCL 11B

The short-circuit currents and photo-emfs were measured for various ceramics including barium titanate, lead metaniobate, and lead titanate. It is suggested that the emfs and currents arise from the presence of photoconductor-insulator sandwiches in the presence of space-charge-produced internal fields. Results are in agreement with the proposed theory and indicate that the ferroelectric ceramics are not only producers of high-voltage photoelectricity but a photo-battery, the polarity and magnitude of which can be switched by application of an electrical signal.
Author

N76-21511* Massachusetts Inst. of Tech., Cambridge. Physics Dept.
OPTICAL ELECTRONICS c74
Ali Javan *In* NASA. Ames Res. Center 2d NASA Conf. on Laser Energy Conversion 1976 p 61-66 refs (For availability see N76-21505 12-36)
CSCL 20F

The development of an optical diode consisting of a metal-dielectric-metal junction in which the high-speed electric conduction process occurs due to quantum mechanical electron tunneling across the dielectric barrier is briefly reviewed. Potential applications of the diode are discussed.
J.M.S.

N76-21512* California Univ., Berkeley. Dept. of Electrical Engineering and Computer Sciences.
OPTICAL DIODES **c74**
T. Kenneth Gustafson *In* NASA. Ames Res. Center 2d NASA Conf. on Laser Energy Conversion 1976 p 67-79 refs (For availability see N76-21505 12-36)
CSCL 20F

Research on metal-barrier-metal structures is reviewed. Topics discussed include: demonstration of antenna coupling and rectification characteristics with high resistance evaporated structures at a wavelength of 10 microns; application of these devices to coherent conversion of laser radiation and infrared and optical circuit elements; and comparison of the point-contact type of diode structure and the newly developed photolithographic structures. J.M.S.

N76-21513* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
IR PUMPED THIRD-HARMONIC GENERATION AND SUM-FREQUENCY GENERATION IN DIATOMIC MOLECULES
Chiao-Yao She (Colo. State Univ., Fort Collins) and Kenneth W. Billman *In its* 2d NASA Conf. on Laser Energy Conversion 1976 p 81-87 refs (For availability see N76-21505 12-36)
CSCL 20E

The potential efficiency of using nonlinear up-conversion techniques for the high efficiency type lasers (CO,CO2, and chemical) is assessed. Results indicate that: the small pump photon energy necessitates the use of molecular media for conversion if resonance enhancement is to be used and that molecular systems present several problems. These difficulties include: their levels are complex; their transition probabilities are often unknown; and the oscillator strengths among vibrational levels in the ground electronic state of a molecule are much smaller than those among electronic states of an atom, thus limiting the magnitude of nonlinear interactions. It is shown that this problem can be eliminated by making use of vibronic transitions which, being primarily electronic transitions have much larger matrix elements and efficient conversion can be achieved with molecular systems. Author

N76-21514* Stanford Univ., Calif.
LASER-ELECTRON BEAM INTERACTION APPLIED TO OPTICAL AMPLIFIERS AND OSCILLATORS
Richard H. Pantell and M. A. Piestrup *In* NASA. Ames Res. Center 2d NASA Conf. on Laser Energy Conversion 1976 p 89-94 (For availability see N76-21505 12-36)
CSCL 20E

Momentum modulation of a relativistic electron beam by a Nd:YAG laser is demonstrated. The electrons, at 100 MeV energy, interact with the laser light in helium gas at standard temperature and pressure. At an angle of 6.55 mrad between the two wavevectors, corresponding to the Cerenkov angle, a given electron remains in a field of constant phase as it passes through the light beam. The experimental arrangement is illustrated showing the trajectories of the electron and light. The particle momentum is measured by a mass spectrometer, and the angle between the wavevectors is controlled by a rotatable mirror. Experimental results indicate that momentum modulation of an electron beam may be used for amplification. A possible configuration for an optical klystron is illustrated. Author

N76-21515* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF HIGH POWER LASERS TO SPACE POWER AND PROPULSION
Donald L. Nored *In its* 2d NASA Conf. on Laser Energy Conversion 1976 p 95-108 refs (For availability see N76-21505 12-36)
CSCL 20E

The transmission of laser power over long distances for applications such as direct conversion to propulsive thrust or electrical power is considered. Factors discussed include: problems inherent in transmitting, propagating, and receiving the laser beam over long ranges; high efficiency, closed-cycle, continuous wave operation; advancement of CO2 laser technology; and compatibility with photovoltaic power conversion devices. J.M.S.

N76-21516* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OUTLOOK FOR METAL LASERS
Gary R. Russell *In* NASA. Ames Res. Center 2d NASA Conf. on Laser Energy Conversion 1976 p 109-117 refs Sponsored by NASA and DARPA (For availability see N76-21505 12-36)
CSCL 20E

Lasers utilizing atomic metallic vapors are considered with emphasis on a double discharge technique and multiply pulsed experiments. Data are presented on the effect of time delay after the first electrical discharge and the effect of lasant temperature along with results of absorption measurements utilizing a 13 mm diameter laser tube. Data obtained from multiply pulsed experiments for discharge diameters varying from 1 to 4 cm indicate that the efficiency increases with the pulsing rate. J.M.S.

N76-21517* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TUNABLE HIGH PRESSURE LASERS
Robert V. Hess *In its* 2d NASA Conf. on Laser Energy Conversion 1976 p 119-126 refs (For availability see N76-21505 12-36)
CSCL 20E

Atmospheric transmission of high energy CO2 lasers is considerably improved by high pressure operation which, due to pressure broadening, permits tuning the laser lines off atmospheric absorption lines. Pronounced improvement is shown for horizontal transmission at altitudes above several kilometers and for vertical transmission through the entire atmosphere. Applications of tunable high pressure CO2 lasers to energy transmission and to remote sensing are discussed along with initial efforts in tuning high pressure CO2 lasers. Author

N76-21518* National Aeronautics and Space Administration, Washington, D.C.
NUCLEAR PUMPED GAS LASER RESEARCH
Karlheinz Thom *In its* 2d NASA Conf. on Laser Energy Conversion 1976 p 127-132 refs (For availability see N76-21505 12-36)
CSCL 20E

Nuclear pumping of lasers by fission-fragments from nuclear chain reactions is discussed. Application of the newly developed lasers to spacecraft propulsion or onboard power, to lunar bases for industrial processing, and to earth for utilization of power without pollution and hazards is envisioned. Emphasis is placed on the process by which the fission-fragement kinetic energy is converted into laser light. J.M.S.

N76-21519* Rasor Associates, Inc., Sunnyvale, Calif.
THERMO ELECTRONIC LASER ENERGY CONVERSION
Lorin K. Hansen and Ned S. Rasor *In* NASA. Ames Res. Center, 2d NASA Conf. on Laser Energy Conversion 1976 p 133-146 refs Sponsored by NASA (For availability see N76-21505 12-36)
CSCL 20E

The thermo electronic laser energy converter (TELEC) is described and compared to the Waymouth converter and the conventional thermionic converter. The electrical output characteristics and efficiency of TELEC operation are calculated for a variety of design variables. Calculations and results are briefly outlined. It is shown that the TELEC concept can potentially convert 25 to 50 percent of incident laser radiation into electric power at high power densities and high waste heat rejection temperatures. J.M.S.

N76-21520* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LASER PLASMADYNAMIC ENERGY CONVERSION
K. Shimada *In* NASA. Ames Res. Center 2d NASA Conf. on Laser Energy Conversion 1976 p 147-155 refs (For availability see N76-21505 12-36)
(Contract NAS7-100)
CSCL 20E

The generation of electrons ions by interacting an intense laser beam with cesium vapor is considered. Theoretical calculation shows that the conversion efficiency is as high as 40 percent if the entire photon energy is utilized in ionizing the cesium vapor that is generated initially by the incoming laser beam. An output voltage is epected to be generated across two electrodes, one of which is the liquid cesium, by keeping the other electrode at a different work function. Evaluation of the laser plasmadynamic

(LPD) converter was performed using pulsed ruby and Nd-glass lasers. Although the results obtained to date indicate an efficiency smaller than that of theoretical predictions, an unoptimized LPD converter did demonstrate the capability of converting laser energy at large power levels. The limitations in the performance may by due to converter geometry, the types of lasers used, and other limitations inherent to the cesium plasma. Author

N76-21521* Physical Sciences, Inc., Wakefield, Mass.
CONVERSION OF LASER ENERGY TO GAS KINETIC ENERGY
George E. Caledonia *In* NASA. Ames Res. Center 2d NASA Conf. on Laser Energy Conversion 1976 p 157-165 refs (For availability see N76-21505 12-36)
(Contract NAS3-18528)
CSCL 20E

Techniques for the gas phase absorption of laser radiation for ultimate conversion to gas kinetic energy are discussed. Particular emphasis is placed on absorption by the vibration rotation bands of diatomic molecules at high pressures. This high pressure absorption appears to offer efficient conversion of laser energy to gas translational energy. Bleaching and chemical effects are minimized and the variation of the total absorption coefficient with temperature is minimal. Author

N76-21522* Washington Univ., Seattle. Aerospace Research Lab.
ADVANCED PHOTON ENGINES
Abraham Hertzberg *In* NASA. Ames Res. Center 2d NASA Conf. on Laser Energy Conversion 1976 p 167-171 refs (For availability see N76-21505 12-36)
CSCL 20E

Photon engines which convert coherent radiation back to energy with efficiencies of approximately 60 percent are considered. Components of the system include; a simple regenerated Brayton cycle, an energy exchanger device, and laser heating techniques. J.M.S.

N76-21523* Westinghouse Research Labs., Pittsburgh, Pa.
OPTIMIZATION OF ENGINES OPERATED REMOTELY BY LASER POWER
Max Garbuny and Martin J. Pechersky *In* NASA. Ames Res. Center 2d NASA Conf. on Laser Energy Conversion 1976 p 173-180 refs Sponsored by NASA (For availability see N76-21505 12-36)
CSCL 20E

General features of laser engines and laser piston engines are discussed in terms of optimization of operation. The efficiency of laser powered turbine and Stirling engines is also considered. J.M.S.

N76-21524* Stanford Univ., Calif. Applied Physics Dept.
INITIAL EXPERIMENTS WITH A LASER DRIVEN STIRLING ENGINE
Robert L. Byer *In* NASA. Ames Res. Center 2d NASA Conf. on Laser Energy Conversion 1976 p 181-188 refs (For availability see N76-21505 12-36)
CSCL 20E

Operation of a Beale free piston Stirling engine with a 40-W CO2 laser is described. Advantages of such a system include: closed-cycle operation, long life, inexpensive construction, and size scalability to 100 MW. J.M.S.

N76-21525*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Electrical Engineering and Applied Physics.
FAR INFRARED MASER COMMUNICATIONS TECHNOLOGY Final Report, 13 May 1974 - 30 Nov. 1975
Paul C. Claspy and Yoh-Han Pao 30 Nov. 1975 42 p
(Grant NGR-36-027-068)
(NASA-CR-146850) Avail: NTIS HC $4.00 CSCL 20E

An optically pumped FIR laser was constructed and tested. Optimum operating conditions were determined with CH3OH as the lasing medium. The laser was found to operate equally well with flowing gas or in a sealed off configuration. The FIR cavity stability and pump laser stability were found to have significant problems. The absorption coefficient per unit pressure of 1-1 difluoroethylene at the P(22) and P(24) lines of the 10.4 micron CO2 band was measured. The FIR line pumped by P(22) occurs at approximately 890 microns, which may be in an atmospheric transmission window. It was found that significant Stark tuning of absorption lines of methanol and 1-1 difluoroethylene can be accomplished, even at the usual 100 to 300 mTorr operating pressures of FIR lasers. This means that the use of Stark tuning may enable more effective use of pump laser output. Author

N76-21526# California Univ., Livermore. Lawrence Livermore Lab.
HIGH-ENERGY GLASS LASERS
J. A. Glaze 15 Aug. 1975 37 p refs Presented at 19th Ann. Tech. Symp. of the Soc. of Photo-Opt. Instrumentation Engr., San Diego, Calif., 18 Aug. 1975 Sponsored by ERDA
(UCRL-77197; Conf-750852-3) Avail: NTIS HC $5.00

In order to investigate intense pulse propagation phenomena, as well as problems in laser and system design, a prototype single chain laser called CYCLOPS was constructed. This laser employs a 20-cm clear aperture disk amplifier in its final stage and produces a terawatt pulse whose brightness exceeds 10 to the 18th power watts/sq cm. The CYCLOPS system is summarized and aspects of nonlinear propagation phenomena that are currently being addressed are discussed. NSA

N76-21527# Sandia Labs., Albuquerque, N.Mex.
HIGH POWER LASER EXCITER ACCELERATORS
T. H. Martin 1975 17 p refs Presented at Intern. Laser Exposition and Electrooptics 1975, Anaheim, Calif., 11 Nov. 1975 Sponsored by ERDA
(SAND-75-5630; Conf-751102-2) Avail: NTIS HC $4.50

Recent developments in untriggered oil and water switching now permit the construction of compact, high energy density pulsed power sources for laser excitation. These accelerators, developed principally for electron beam fusion studies, appear adaptable to laser excitation and will provide electron beams of 10 to the 13th power to 10 to the 14th power W in the next several years. The accelerators proposed for e-beam fusion essentially concentrate the available power from the outside edge of a disk into the central region where the electron beam is formed. One of the main problem areas, that of power flow at the vacuum diode insulator, is greatly alleviated by the multiplicity of electron beams that are allowable for laser excitation. A proposal is made whereby the disk-shaped pulsed power sections are stacked vertically to form a series of radially flowing electron beams to excite the laser gas volume. Author (NSA)

N76-21528# Los Alamos Scientific Lab., N.Mex.
PULSED HYDROGEN FLUORIDE LASER OSCILLATOR-AMPLIFIER EXPERIMENTS
G. L. Schott 1975 9 p refs Presented at the Seminar on Optical Methods in Energy Conversion, Rochester, N. Y., 23 Jun. 1975
(Contract W-7405-eng-36)
(LA-UR-75-1422; Conf-750666-1) Avail: NTIS HC $4.00

Pulsed HF chemical laser oscillator energies were scaled from millijoules to several kilojoules over the period 1970-1974, reaching approximately 10 J with SF6 and transverse discharges, and using electron-beam initiation and elemental F sub 2 above 1000J. This demonstrated that scalability to large energy with acceptable electrical efficiency is only one prerequisite for application of this gas laser in fusion. Of equal importance is the achievement of focusable, approximately 1 ns pulses, couplable to light-element targets, all from an affordable system. Exploratory MOPA experiments are reported which address control of HF laser beam focusability and pulse duration, using SF6-based experimental oscillator-amplifier sequences and Pockels' cell switching. Author (NSA)

N76-21529# Los Alamos Scientific Lab., N.Mex.
COLD CATHODE INVESTIGATION
J. P. Rink Jun. 1975 5 p refs
(Contract W-7405-eng-36)
(LA-6009-MS) Avail: NTIS HC $4.00

Experiments for the evaluation of a cold cathode electron gun are described. Different anode and cathode materials and configurations were tried. Small signal gains of 6.3 percent/cm were measured. It was found that the same small signal gains could be obtained with less energy deposition in the laser gas with the larger pre-ionizing currents from a cold cathode.

Long-duration pulses were observed that were limited only by the electrical energy available in the Marx bank. Author (NSA)

N76-21530# Los Alamos Scientific Lab., N.Mex.
PREHEAT EFFECTS ON MICRO-BALLOON LASER FUSION IMPLOSIONS
G. S. Fraley Jul. 1975 5 p refs Sponsored by ERDA
(LA-6046-MS) Avail: NTIS HC $4.00

Nonequilibrium hydroburn simulations of early laser-driven compression experiments indicate that low energy photons from the vicinity of the ablation surface are preheating the micro-balloon-pushers, thereby severely limiting the compressions achieved (similar degradation may result from 1 to 4 percent energy deposition by superthermal electrons). This implies an 8- to 27-fold increase in the energy requirements for breakeven, unless radiative preheat can be drastically reduced by, say, the use of composite ablator-pushers. Author (NSA)

N76-21531# Los Alamos Scientific Lab., N.Mex.
STRUCTURE AND SCALING LAWS OF LASER-DRIVEN ABLATIVE IMPLOSIONS
S. J. Gitomer and B. S. Newberger Aug. 1975 3 p refs
(Contract W-7405-eng-36)
(LA-6079-MS) Avail: NTIS HC $4.00

A stationary, spherical flow model gives the form of laser-driven ablation fronts and scaling laws for the dependence of implosion parameters on laser wavelength, pusher atomic number, and other input quantities. Author (NSA)

N76-21532# Bendix Corp., Kansas City, Mo.
SORTING AND HANDLING LASER TARGETS
J. H. Kuehnle May 1975 19 p
(Contract AT(29-1)-613)
(DBX-613-1325) Avail: NTIS HC $4.00

Techniques have been developed for separating round, hollow microspheres having uniform wall thickness from bulk quantities of glass and metal microballoons. The process is capable of yielding small quantities of thin-walled (1 mu m), closely-sized microspheres, in the diameter range of 20 to 250 mu m. The air jet sieving and microradiographic techniques employed are described. Author (NSA)

N76-21533# California Univ., Livermore. Lawrence Livermore Lab.
OPTICAL PULSE COMPRESSION
A. J. Glass 16 Apr. 1975 7 p refs Presented at the Intern. Conf. on Energy Storage, Compression and Switching, Torino, Italy, 5 Nov. 1974 Sponsored by ERDA
(UCRL-76702; Conf-741113-13) Avail: NTIS HC $4.00

The interest in using large lasers to achieve a very short and intense pulse for generating fusion plasma has provided a strong impetus to reexamine the possibilities of optical pulse compression at high energy. Pulse compression allows one to generate pulses of long duration (minimizing damage problems) and subsequently compress optical pulses to achieve the short pulse duration required for specific applications. Of the two approaches considered, the Gires-Tournois approach is limited by the fact that the bandwidth and compression are intimately related, so that the group delay dispersion times the square of the bandwidth is about unity for all simple Gires-Tournois interferometers. The Treacy grating pair is inefficient because diffraction generally occurs in several orders and is limited by the problem of optical damage to the grating surfaces themselves. Nonlinear and parametric processes were explored.Author (NSA)

N76-21534# Sandia Labs., Albuquerque, N.Mex.
ELECTRON-BEAM-DRIVEN HIGH-POWER HYDROGEN FLUORIDE LASERS
J. B. Gerardo May 1975 4 p Presented at the IEEE Optical Soc. of Am. Conf. on Laser, Eng. and Appl., Wash., D. C., 28 May 1975 Sponsored by ERDA
(SAND-75-5461; Conf-750520-4) Avail: NTIS HC $4.00

A laser that produces a 4.2 kJ pulse is briefly described. Pulse widths from the laser ranged from 20 to 30 ns; peak power was about 200-billion W. The 4.2-kJ pulse is nearly double the previous record pulse for an HF laser, also an electron-beam-driven system. The HF pulse was produced by injecting an intense beam of electrons from the REBA accelerator into a 2.3-m-long, 15-cm-dia tube filled with hydrogen, fluorine, sulfur-hexafluorine, and oxygen at pressures up to two atmospheres. A 3-kG magnetic field guided the electron beam along the axis of the gas-filled cell. REBA delivers a 50 kA beam of 2-MeV electrons in a 70 ns-wide pulse. Author (NSA)

N76-21535# California Univ., Livermore. Lawrence Livermore Lab.
ISOTOPE SEPARATION BY LASER DEFLECTION OF AN ATOMIC BEAM
A. F. Bernhardt Feb. 1975 108 p refs
(Contract W-7405-eng-48)
(UCRL-51796) Avail: NTIS HC $5.45

Separation of isotopes of barium was accomplished by laser deflection of a single isotopic component of an atomic beam. With a tunable narrow linewidth dye laser, small differences in absorption frequency of different barium isotopes on the 6S21S0-6S6P 1P1 5536A resonance were exploited to deflect atoms of a single isotopic component of an atomic beam through an angle large enough to physically separate them from the atomic beam. It is shown that the principal limitation on separation efficiency, the fraction of the desired isotopic component which can be separated, is determined by the branching ratio from the excited state into metastable states. The isotopic purity of the separated atoms was measured to be in excess of 0.9, limited only by instrumental uncertainty. To improve the efficiency of separation, a second dye laser was employed to excite atoms which had decayed to the 6s5d metastable state into the 6p5d 1P1 state from which they could decay to the ground state and continue to be deflected on the 5535A transition. GRA

N76-21536# Sandia Labs., Albuquerque, N.Mex.
DYE LASER SPECTROMETER FOR THE ANALYSIS OF PULSED VACUUM ARCS
P. J. Hargis, Jr. and M. M. Robertson 1975 8 p Presented at IEEE Opt. Soc. of Am. Conf. on Laser Eng. and Appl., Washington, D. C., 28 May 1975 Sponsored by ERDA
(SAND-75-5014; Conf-750520-2) Avail: NTIS HC $4.00

A pulsed dye laser spectrometer which is used to obtain detailed single shot spectroscopic measurements of the plasma in a pulsed vacuum arc was developed. The capabilities of this spectrometer are indicated by the detection of laser induced fluorescence signals from 1,000,000 neutral Ti atoms in the plasma of a pulsed vacuum arc with a Ti anode. Author (NSA)

N76-21537# California Univ., Livermore. Lawrence Livermore Lab.
THE 1.06 mu m 150 psec LASER DAMAGE STUDY OF DIAMOND TURNED, DIAMOND TURNED/POLISHED AND POLISHED METAL MIRRORS
T. T. Saito (AFWL, Kirkland AFB, N. Mex.), D. Milam, P. Baker, and G. Murphy 24 Jul. 1975 33 p refs Presented at Symp. on Damage in Laser Mater., Boulder, Colo., 29-31 Jul. 1975 Revised Sponsored by ERDA
(UCRL-76822-Rev-1; Conf-750730-2) Avail: NTIS HC $4.75

Using a well characterized 1.06 mu m 150 ps glass laser pulse the damage characteristics for diamond turned, diamond turned/polished, and polished copper and silver mirrors less than 5 cm diameter were studied. Although most samples were tested with a normal angle of incidence, some were tested at 45 deg with different linear polarization showing an increase in damage threshold for S polarization. Different damage mechanisms observed are discussed. Laser damage is related to residual surface influences of the fabrication process. First attempts to polish diamond turned surfaces resulted in a significant decrease in laser damage threshold. The importance of including the heat of fusion in the one dimensional heat analysis of the theoretical damage threshold and how close the samples came to the theoretical damage threshold is discussed. Author (NSA)

N76-21538# Sandia Labs., Albuquerque, N.Mex.
ELECTRON BEAM FUSION TARGETS
M. J. Clauser and M. A. Sweeney 1975 17 p refs Presented at IEEE Intern. Conf. on Plasma Sci., Ann Arbor, Mich., 14 May 1975 Sponsored by ERDA
(SAND-75-5417; Conf-750531-1) Avail: NTIS HC $4.00

The behavior of the Deuterium-Tritium filled gold shells when irradiated by a variety of pulse shapes was studied. In

these pulses the power (and beam current) was varied, but the voltage was kept constant at 1 MeV. In general the performance of the target, for a given peak power, was not significantly affected by the pulse shape. Pulses with rise times of up to half the implosion time do not significantly degrade the target performance. The use of the 'optimal pulse' of laser fusion with a fixed peak power does not appear to improve the performance of these targets. The main function of the 'optimal pulse' is to produce a large rho r of the target during the thermonuclear burn. In e-beam targets a total rho r of 5 to 10 g/sq cm can be obtained without pulse shaping; the problem here is one of achieving high enough temperatures to ignite the Deuterium-Tritium NSA

N76-21539# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RESEARCH APPROACHES FOR X-RAY LASERS
A. Carillon, P. Jaegle, G. Jamelot, and A. Sureau 20 Mar. 1975 19 p refs Transl. into ENGLISH from Onde Elec. (France), v. 54, no. 9, 1974 p 441-445
(AD-A017800; FTD-HC-23-1085-75) Avail: NTIS CSCL 20/5

This article reviews research on X ray lasers. Topics discussed are: Pumping of neutral atoms with photoionization; Realization of population inversions in dense plasmas; Experimental research for triply charged ions of an aluminum plasma. GRA

N76-21540# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
ATMOSPHERIC TRANSMITTANCE FROM 0.25 TO 28.5 MICRONS: COMPUTER CODE LOWTRAN 3 Environmental Research Papers
J. E. A. Selby and R. A. McClatchey 7 May 1975 112 p refs
(AF Proj. 7670)
(AD-A017734; AFCRL-TR-75-0255; AFCRL-ERP-513) Avail: NTIS CSCL 20/6

A FORTRAN computer program, LOWTRAN 3, is described for calculating the transmittance of the atmosphere in the spectral region from 0.25 to 28.5 micrometers at a spectral resolution of 20/cm. The program provides a choice of six atmospheric models covering seasonal and latitudinal variations from sea level to 100 km, two haze models, and accounts for molecular absorption, molecular scattering, and aerosol extinction. Refraction and earth curvature effects are also included. This program provides some modifications to the molecular absorption and aerosol extinction data provided in an earlier LOWTRAN 2 report. In addition, input modifications have been made, making the LOWTRAN 3 program considerably more flexible in terms of the input of meteorological data. GRA

N76-21541# Oklahoma State Univ., Stillwater. Dept. of Physics.
GROWTH AND HARDENING OF ALKALI HALIDES FOR USE IN INFRARED LASER WINDOWS Final Report, 1 May 1972 - 31 Jul. 1975
Joel J. Martin, Charles T. Butler, and William A. Sibley L. G. Hanscom Field, Mass. AFCRL 31 Jul. 1975 60 p refs
(Contract F19628-72-C-0306; ARPA Order 2055)
(AD-A017960; AFCRL-TR-75-0432) Avail: NTIS CSCL 20/6

KCl crystals pulled from pretreated melts under an Ti gettered inert atmosphere have been shown to have as low an absorption as crystals grown by the RAP Bridgman method. A simple optical method has been developed to analyze KCl:Eu for Eu content. Radiation damage significantly increases the 10.6 micrometers absorption of both KCl and NaCl. The absorption increase is caused by the F-aggregate centers. This result probably rules out the use of radiation strengthened KCl for high power laser window applications. The flow stress of KCl:Eu was found to increase linearly with Eu content. The flow stresses of KBr(x)Cl(1-x) crystals have the same temperature dependence as the flow stress of pure KCl. GRA

N76-21542# Princeton Univ., N.J. Dept. of Chemistry.
COLLISIONAL STUDIES OF GASEOUS MOLECULAR LASERS
Herschel Rabitz Nov. 1975 152 p refs
(Contract N00014-75-C-0478)
(AD-A017791; PR-2) Avail: NTIS CSCL 20/5

Collisional relaxation studies under way at Princeton are reviewed. Three areas of research are involved: (1) Vibration-translation relaxation in He-CO; (2)Rotation-translation relaxation in hydrogen; and (3)A stochastic theory for molecular collisions. GRA

N76-21543# Naval Weapons Center, China Lake, Calif.
LASER DAMAGE MEASUREMENTS AT CO2 AND DF WAVELENGTHS
J. O. Porteus, M. J. Soileau, H. E. Bennett, and M. Bass Nov. 1975 20 p refs
(RR0220202)
(AD-A017951; NWC-TP-5810) Avail: NTIS CSCL 20/6

Preliminary results from laser damage tests conducted with CO2 and DF lasers on samples mounted in a newly constructed ultrahigh vacuum sample chamber are reported. The lasers operate single mode and the pulse lengths are 100 nsec for CO2 and about 500 nsec for DF. A precise method of focusing which permits accurate determination of power densities is described. Incorporated in the test chamber are a scanning electron imager, an optical microscope, a profiling Auger system and a charged particle collector for in situ analysis. Analytical results are presented and implications for physical damage processes are discussed. Measurements in nitrogen on aluminum samples indicate that the threshold for N2 breakdown is reduced some 20 times in the vicinity of the aluminum surface. Laser supported gas plasma waves are formed which shield the surface, and no physical damage occurs for single 100 nsec pulses even at power levels of 10 GW/sq cm. However, in vacuum damage does occur at about the expected power levels. GRA

N76-21544# Hughes Research Labs., Malibu, Calif.
TEN POINT SIX MICRON PARAMETRIC FREQUENCY CONVERTER Semiannual Technical Report, 1 Mar. - 31 Oct. 1975
R. L. Abrams, C. K. Asawa, and A. E. Popa 3 Nov. 1975 57 p refs
(Contract N00014-75-C-0089; ARPA Order 1806)
(AD-A017863; SAPR-2) Avail: NTIS CSCL 20/6

This program represents an effort to demonstrate nonlinear mixing induced in a molecular gas by the application of a dc electric field. In particular, the molecule NH2 D is considered as a three-level system interacting simultaneously with applied infrared and microwave radiation. A resonant nonlinear interaction occurs resulting in the generation of a third frequency. This process is allowed because of the removal of inversion degeneracy in the gas by the applied field. A new, completely enclosed, ridged waveguide Stark cell was developed. Single sideband parametric conversion at the difference frequency between the incident CO2 laser radiation and the 4 GHz microwave radiation was accomplished with the modified cell, as predicted. This represents the first observation of resonantly-enhanced Stark-induced two-photon mixing in a gas. The parametric signal was further examined as a function of the Stark voltage, NH2 D pressure, the microwave frequency and power. The results generally confirm predictions. GRA

N76-21545# Harry Diamond Labs., Adelphi, Md.
EVALUATION OF A LIMITING MIRROR FOR LASER EYE AND SENSOR PROTECTION
Z. G. Sztankay, R. J. Wellman, and D. McGuire Apr. 1975 143 p refs
(DA Proj. 1J6-62713-DJ-40)
(AD-A017733; HDL-TR-1683) Avail: NTIS CSCL 20/6

A system to provide eye or sensor protection from laser-beam damage is investigated. Light beams exceeding a safe energy density are prevented from reaching the observer or sensor by the destruction of a mirror in the line-of-sight. The replaceable mirror consists of a 10- to 20-nm vacuum-deposited metal film on a 2- to 8-micrometer black plastic substrate. The mirror is vaporized directly by focusing the input beam on it. The vaporization, which occurs fast enough to protect against Q-switched lasers, prevents the potentially damaging radiation from reaching the eye or sensor. The energy reflected by various prototype limiting mirrors is measured as a function of the incident energy in an experimental arrangement employing 1-J Q-switched and normal-pulsed ruby, and 2-W CW argon laser beams. GRA

N76-21546# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
SIMULTANEOUS MEASUREMENT OF LASER EXTINCTION IN WARM FOG AT WAVE LENGTHS OF 0.6328, 1.15 AND 10.6 MICRONS Research Report
Richard H. Munis and Allan J. Delaney Oct. 1975 13 p refs (ARPA Order 1615)
(AD-A017943; CRREL-RR-343) Avail: NTIS CSCL 20/6

Simultaneous laser extinction measurements were made in warm fog at wavelengths of 0.6238, 1.15 and 10.6 micrometers. The warm fog generated in a 4 cu m environmental chamber. Particle sampling was carried out simultaneously with the laser measurements using an impactor. Using the same size distribution in each case the theoretical extinction coefficients were calculated and compared with the experimental coefficients. Results obtained during this experiment and a previous one indicate that propagation at 1.15 micrometers is adversely affected by the presence of atmospheric water vapor. Experimental data obtained simultaneously at 0.6328 and 10.6 micrometers indicate that virtually no difference exists between the extinction coefficients at these two wavelengths for moderate particle concentrations while at much larger concentrations alpha sub 0.6328 increases indefinitely while alpha sub 10.6 levels off at 0.2. GRA

N76-21547# Optical Science Consultants, Yorba Linda, Calif.
POWER SPECTRA REQUIREMENTS FOR WAVEFRONT-COMPENSATIVE SYSTEMS Final Report, 1 Jun. 1973 - 1 Jun. 1975
David L. Fried and Darryl P. Greenwood Sep. 1975 133 p refs
(Contract F30602-74-C-0115)
(AD-A018045; RADC-TR-75-227) Avail: NTIS CSCL 20/6

The phase degradation of an optical wavefront distorted by turbulence in the propagation medium may be corrected in a piece-wise-linear fashion by using an array of small circular mirrors. An option in the correction scheme is to compensate for overall tilt separately. The authors have evaluated power spectra and variances of the piston and tilt motions of the mirror segments as well as the motion of the overall tilt corrector. The form of the spectra for any propagation medium is an aperture integral of the product of the phase-difference power spectrum, describing the medium, and a generalized transfer function, representing the aperture and its segments. A set of standard curves is found to represent a generalized slice, and the differential contributions may be summed to represent any propagation path. The standard curves, further modeled in terms of power law dependencies, are programmed for use on a desk calculator. For a generalized turbulence and velocity model representing the ARPA Maui Optical Station, power spectra and variances are evaluated using both exact numerical integration and power law modeling. GRA

N76-21548# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
COMBUSTOR COMPONENT DEVELOPMENT, HELIUM-SATURATED PROPELLANT, VOLUME 3 Final Report, Oct. 1974 - Feb. 1975
H. A. Arbit Nov. 1975 111 p refs
(Contract F29601-72-C-0140; AF Proj. 317J)
(AD-A018021; R-9652-Vol-3; AFWL-TR-74-283-Vol-3) Avail: NTIS CSCL 20/5

A series of test firings of a full-scale, gas/liquid, N2O/CO/CH4/N2 GDL combustor was performed to determine the effect of helium saturation of the N2O (at 1300 psi and 0 F, corresponding to about 1.5 mole percent He) on combustor performance, stability, feed/system controls, and heat flux, and on product gas uniformity. Eight tests were carried out. The results showed that this level of helium saturation of the N2O had no measurable effect on combustor performance (c* efficiency remained at 99 percent), dynamic stability (combustor remained stable), heat flux, or product gas uniformity. Solution of helium in N2O at levels greater than 0.5 mole percent did, however, affect the functioning of the N2O cavitating venturi flow controller by significantly decreasing the discharge coefficient of the venturi throat. In the course of the test program, the GDL secondary (nitrogen) injector was modified to improve its mixing efficiency. Experimental measurements made over the product gas flowfield showed that the modified injector configuration gave produce gas with high degrees of thermal and compositional uniformity. Author (GRA)

N76-21549# United Technologies Corp., East Hartford, Conn.
HIGH POWER DYE LASERS Final Technical Report, 1 Jan. 1973 - 30 Sep. 1975
W. W. Morey, W. H. Glenn, and C. M. Ferrar 30 Sep. 1975 156 p refs
(Contract N00014-73-C-0284; ARPA Order 1806)
(AD-A017272; R75-921617-13) Avail: NTIS CSCL 20/5

This report discusses the development of a high average power, flashlamp pumped dye laser. This program has resulted in the development of a dye laser with a power output of 102 watts at a repetition rate of 250 Hz. This was made possible by the development of a vortex stabilized flashlamp that can be oeprated at high average power and high repetition rate. The report discusses the properties of the flashlamp in detail and describes two laser configurations that were tested, a longitudinal dye flow laser and a transverse dye flow laser. A pulse compression scheme to obtain a high time resolution with a long laser pulse is presented and some preliminary experiments are described. GRA

N76-21550# Informatics, Inc., Rockville, Md.
EFFECTS OF HIGH POWER LASERS, NO. 6 MARCH - OCTOBER 1975
Stuart G. Hibben, J. Kourilo, M. Ness, and B. Shresta 12 Nov. 1975 84 p refs
(Contract MDA903-76-C-0099; DARPA Order 3097)
(AD-A017790) Avail: NTIS CSCL 20/5

The sixth compilation is presented of abstracts of Soviet studies on high power laser technology, covering material published from March through October 1975. Articles are grouped by laser interaction with metals, dielectrics, semiconductors, miscellaneous targets, and laser-plasma interaction. Author (GRA)

N76-21551# Ballistic Research Labs., Aberdeen Proving Ground, Md.
TRAJECTORY CALCULATIONS ON THE FLUORINE METHANE CHEMICAL LASER REACTION
Arthur Gauss, Jr. Oct. 1975 53 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A017756; BRL-1836) Avail: NTIS CSCL 07/4

Fluorine atoms react with methane at low collision energies according to the chemical-laser reaction; F-CH4 to HF(*)-CH3. At somewhat higher energies (1-1.5 eV) the reaction F-CH4 to FCH3-H is possible. The fluorine-methane system is considered in this analysis as a three-particle system consisting of a fluorine atom, a hydrogen atom, and a methyl radical. The use of a three-parameter London-Eyring-Polyanyi-Sato (LEPS) potential, energy surface, in conjunction with Monte Carlo trajectory calculations, has made it possible to reproduce theoretically the results of several experiments and to make a prediction for another. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N76-21552 Engineering Sciences Data Unit, London (England).
CALCULATION METHODS FOR STEADY LOADED TILTING PAD THRUST BEARING
Oct. 1975 21 p
(ESDU-75023) For information on availability of series, sub-series and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $194.50

The report is another in the series on calculation methods for various types of hydrodynamic bearings, dealing this time with the tilting pad thrust bearing. A drastic simplification of the analysis has been achieved in this case by dealing only with those bearings having pad proportions in the most suitable range for efficient operation. In practice few bearings would be designed outside this range, so the loss of generality is not important. The flexibility needed to design for operation with

any liquid lubricant and with any practical size, speed and loading combination (where the flow remains laminar) has been retained. The report gives data and a method for calculating suitable bearing dimensions for a given load, speed and lubricant, and gives data for estimating the resulting film-thickness, power loss, lubricant flow rate and temperatures. The method of design is illustrated by three examples dealing with different problems that can arise in the design. ESDU

N76-21553 Engineering Sciences Data Unit, London (England).
ELASTIC STRESS CONCENTRATION FACTORS. DOUBLE RADIUS FILLETS IN SHOULDERED SHAFTS IN TORSION
Nov. 1975 6 p
(ESDU-75033) For information on availability of series, sub-series and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $74.50

The report deals with the reduction in stress concentration in shoulders in shafts subjected to torsion by using a double radius fillet in preference to a simple circular fillet. Situations where this design becomes of value are cases where the available area into which the fillet must go is limited either by the height up the shoulder or the length along the shaft. Under either or both such constraints the report provides curves which show the maximum achievable reduction in stress and the fillet proportions necessary to obtain it. ESDU

N76-21554* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPARATUS FOR POSITIONING MODULAR COMPONENTS ON A VERTICAL OR OVERHEAD SURFACE Patent
Cyrus C. Haynig (Rockwell Intern. Corp., Downey Calif.) and Samuel V. Messineo, inventors (to NASA) (Rockwell Intern. Corp., Downey, Calif.) Issued 23 Mar. 1976 6 p Filed 30 Aug. 1974 Supersedes N74-32926 (12 - 22, p 2701) Sponsored by NASA
(NASA-Case-LAR-11465-1; US-Patent-3,945,879; US-Patent-Appl-SN-502137; US-Patent-Class-156-556; US-Patent-Class-33-1G; US-Patent-Class-33-174B; US-Patent-Class-156-286; US-Patent-Class-156-382; US-Patent-Class-248-362; US-Patent-Class-248-363; US-Patent-Class-269-21) Avail: US Patent Office CSCL 13I

An apparatus is disclosed for holding a plurality of modular components against a surface. A fixture prepositions the components and a vacuum develops a uniform pressure which presses and holds the fixture and objects against a surface. The surface may be curved, vertical, or overhead and since local load concentrations are avoided, fragile ceramic tiles may be installed using the apparatus.
Official Gazette of the U.S. Patent Office

N76-21555*# National Aeronautics and Space Administration, Washington, D.C.
MECHANICAL DEVICES: A COMPILATION Technology Utilization
Jan. 1976 39 p
(NASA-SP-5976(05)) Avail: NTIS HC $1.00 CSCL 13I

A collection of new technology items that should be of interest to mechanical engineers, machinists, and others who design or work with mechanical devices was described. Section 1 contains articles on several new or modified tools, Section 2 describes a number of specialized mechanical systems, and the last section is devoted to valves, bearings, and other parts that might be used with larger systems. The last patent information available is also given. Author

N76-21556*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FRICTION AND WEAR OF TITANIUM ALLOYS AND COPPER ALLOYS SLIDING AGAINST TITANIUM 6-PERCENT-ALUMINUM - 4-PERCENT-VANADIUM ALLOY IN AIR AT 430 C
Donald W. Wisander Washington Apr. 1976 15 p refs
(NASA-TN-D-8207; E-8522) Avail: NTIS HC $3.50 CSCL 20K

Experiments were conducted to determine the friction and wear characteristics of aluminum bronzes and copper-tin, titanium-tin, and copper-silver alloys sliding against a titanium-6% aluminum-4% vanadium alloy (Ti-6Al-4V). Hemispherically tipped riders of aluminum bronze and the titanium and copper alloys were run against Ti-6Al-4V disks in air at 430 C. The sliding velocity was 13 cm/sec, and the load was 250 g. Results revealed that high tin content titanium and copper alloys underwent significantly less wear and galling than commonly used aluminum bronzes. Also friction force was less erratic than with the aluminum bronzes. Author

N76-21557*# Northwestern Univ., Evanston, Ill.
INFLUENCE OF SURFACE ROUGHNESS AND WAVINESS ON FILM THICKNESS AND PRESSURE DISTRIBUTION IN ELASTOHYDRODYNAMIC CONTACTS Final Report
Lorac S. H. Chow and Herbert S. Cheng Apr. 1976 158 p refs
(Grant NGR-14-007-084)
(NASA-CR-2670) Avail: NTIS HC $6.75 CSCL 11H

The Christensen theory of a stochastic model for hydrodynamic lubrication of rough surfaces was extended to elastohydrodynamic lubrication between two rollers. Solutions for the reduced pressure at the entrance as a function of the ratio of the average nominal film thickness to the rms surface roughness, were obtained numerically. Results were obtained for purely transverse as well as purely longitudinal surface roughness for cases with or without slip. The reduced pressure was shown to decrease slightly by considering longitudinal surface roughness. The same approach was used to study the effect of surface roughness on lubrication between rigid rollers and lubrication of an infinitely wide slider bearing. Using the flow balance concept, the perturbed Reynolds equation, was derived and solved for the perturbed pressure distribution. In addition, Cheng's numerical scheme was modified to incorporate a single two-dimensional elastic asperity on the stationary surface. The perturbed pressures obtained by these three different models were compared. Author

N76-21558*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
[MANUFACTURE OF GLASS-TO-METAL SEALS WHEREIN THE CLEANLINESS OF THE PROCESS IS ENHANCED AND THE LEAK RESISTANCE OF THE RESULTING SEAL IS MAXIMIZED] Patent Application
Ted J. Podgorski, inventor (to NASA) (Honeywell, Inc. Minneapolis, Minn.) Filed 1 Apr. 1976 9 p
(Contract NAS1-11010)
(NASA-Case-LAR-11563-1; US-Patent-Appl-SN-672815) Avail: NTIS HC $3.50 CSCL 11A

A method for making a glass-to-metal seal is disclosed. A domed metal enclosure having a machined seal ring is fitted to a glass post machined to a slight taper and to the desired surface finish. The metal part is then heated by induction in a vacuum. As the metal part heats and expands relative to the glass post, the metal seal ring, possessing a higher coefficient of expansion than the glass post, slides down the tapered post. Upon cooling, the seal ring crushes against the glass post forming the seal. The method results in a glass-to-metal seal with extremely good leak resistance, while the parts are kept clean and free of contaminants. NASA

N76-21559# Sydney Univ. (Australia). Dept. of Aeronautical Engineering.
EFFECT OF TAPER AND VARIABLE FASTENER FLEXIBILITY ON LOAD TRANSFER THROUGH DOUBLE LAP JOINT IN TENSION
Grant P. Steven Oct. 1975 26 p ref
(ATN-7502) Avail: NTIS HC $4.00

In a previous investigation of load transfer through a double lap joint with five colinear fasteners, it was found that two mathematical models for the mechanism of load transfer were in resonable agreement with experimental results. Further aspects of the above mathematical models were investigated. The first is an extension of the continuous load transmission model. In the second aspect, the flexibilities of the two outer bolts of a five bolt joint are allowed to increase in relation to the flexibilities of the remaining bolts. Author

N76-21560*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FACE-SEAL LUBRICATION: 1: PROPOSED AND

PUBLISHED MODELS
Lawrence P. Ludwig Washington Apr. 1976 38 p refs
(NASA-TN-D-8101; E-8460) Avail: NTIS HC $4.00 CSCL 11A

The numerous published theories on the mechanism of hydrodynamic lubrication of face seals were reviewed. These theories employ either an inclined-slider-bearing macrogeometry or an inclined-slider-bearing microgeometry to produce hydrodynamic pressure that separates the surfaces of the primary seal. Secondary seal friction and primary ring inertia effects are not considered. Hypothetical seal operating models were devised to include secondary seal friction and primary ring inertia effects. It was hypothesized that these effects induce relative angular misalinement of the primary seal faces and that this misalinement is, in effect, an inclined slider macrogeometry. Stable running was postulated for some of these hypothetical operating models. In others, periodic loss of hydrodynamic lubrication was postulated to be possible with certain combinations of waviness and angular misalinement. Application of restrictions that apply to seal operation led to a hydrodynamic governing equation for the new model that is a two-dimensional, time-dependent Reynolds equation with the short-bearing approximation. Author

N76-21561*# National Aeronautics and Space Administration, Washington, D.C.
VALVES AND OTHER MECHANICAL COMPONENTS AND EQUIPMENT: A COMPILATION Technology Utilization
Jan. 1976 32 p ref
(NASA-SP-5976(02)) Avail: NTIS HC $1.00 CSCL 13K

The articles in this Compilation will be of interest to mechanical engineers, users and designers of machinery, and to those engineers and manufacturers specializing in fluid handling systems. Section 1 describes a number of valves and valve systems. Section 2 contains articles on machinery and mechanical devices that may have applications in a number of different areas.
Author

N76-21562# Naval Ship Research and Development Center, Bethesda, Md.
THEORETICAL ANALYSIS OF SWING-PAD BEARINGS
Charles W. Dawson Jun. 1975 21 p refs
(ZF61412001)
(AD-A017777; DTNSRDC-4694) Avail: NTIS CSCL 13/9

The Swing-Pad bearing is a new lubricated sliding-surface bearing. The surfaces are kept separate by fluid-dynamic forces produced by the swinging action of the bearing pads. The standard Reynolds equations of lubrication theory are solved for a simple example of this bearing and simple formulas are obtained for predicting the bearing performance. Author (GRA)

N76-21563# Standards Association of Australia, North Sydney.
AUSTRALIAN STANDARD METHODS FOR THE RADIOGRAPHIC EXAMINATION OF FUSION WELDED BUTT JOINTS IN STEEL (METRICATION AND REVISION OF AS B164-1965)
15 Mar. 1975 21 p
(SAA-DR-75037) Avail: ERDA Depository Libraries HC $4.25

This standard sets out methods for the radiographic examination of fusion welded joints in steel by the use of X-rays or gamma rays. Methods described are based on procedures in which the film lies parallel and adjacent to one surface of the weld and the source of radiation is on the remote site of the weld and at some distance from it. Author (NSA)

N76-21564# Kernforschungszentrum, Karlsruhe (West Germany). Lab. fuer Isotopentechnik.
WEAR MEASUREMENTS BY MEANS OF RADIONUCLIDES
B. Herkert Jul. 1975 37 p refs In GERMAN
(KFK-2182) Avail: ERDA Depository Libraries HC $5.00

Oil transport of wear particles is the most frequently used method of wear measurement by means of radionuclides. The measuring method, calibration, and all essential factors governing wear measurements are treated. It is shown how the activity of the machine parts can be computed, the wear of which is to be measured. The gamma spectra of the involved radionuclides and all relevant measuring conditions are taken into account.
Author (NSA)

N76-21565# Bettis Atomic Power Lab., West Mifflin, Pa.
TEMPERATURE MEASUREMENTS IN A FREE BURNING ARC
S. S. Glickstein Sep. 1975 61 p
(Contract E(36-1)-GEN-14)
(WAPD-TM-1216) Avail: NTIS HC $5.50

Spectroscopic analysis of a 100-A gas tungsten arc welding arc indicates an arc temperature of 1100 K near the cathode, decreasing toward the anode to 8000 K. At these temperatures, the argon gas is approximately 2 percent ionized, and the electron density and conductivity of the gas are sensitive to small changes in arc temperature. The arc temperature with a stationary molten anode is similar to that with a cooled anode. Photographs of the arc indicate an expanding plasma region with increased arc current. The axial temperature at the arc midplane follows the equation T equals (7643 + 18.8 I)K. NSA

N76-21566# Bettis Atomic Power Lab., West Mifflin, Pa.
POROSITY IN WELDS
G. P. Marino Aug. 1975 27 p refs
(Contract E(36-1)-GEN-14)
(WAPD-TM-1202) Avail: NTIS HC $4.50

A theory for the formation of gas bubbles in liquid weld puddles resulting from gaseous impurities (hydrogen, water vapor, or nitrogen) in the shielding gas was developed. The analysis is based upon the thermodynamic requirements for gas bubble nucleation in liquids and presumes a gas supercharging mechanism into the liquid via dissociation of the polyatomic gas impurities in the plasma. Results are presented in graphical form which gives the temperature and impurity level sufficient to cause porosity in the welding of zirconium, aluminum, and nickel. The graphs yield lower limits for impurity contents and are, therefore, conservative in their predictions. Author (NSA)

N76-21567# Goodyear Atomic Corp., Piketon, Ohio.
OPERATING EXPERIENCE WITH ALUMINUM BEARINGS AT THE PORTSMOUTH GASEOUS DIFFUSION PLANT
C. O. Langebrake 16 Jun. 1975 9 p refs
(Contract AT(33-2)-1)
(GAT-827) Avail: NTIS HC $4.00

Considerable operating experience has been gained at the Portsmouth Gaseous Diffusion Plant over the last 15 years in the use of aluminum bearings in process related and auxiliary equipment. All of this experience has been excellent and, in several cases, the use of this type of bearing material has solved significant operating problems. Aluminum 850-T101 alloy was first used as a bearing material in purge cascade (PC-9) centrifugal compressors where a fatigue problem was being experienced with babbitt-type bearings. Good experience in this application led to the extended use of this bearing material in other equipment including process related as well as auxiliary equipment. Since 1961 aluminum bearings have been installed in approximately 21 Type PC-9 (centrifugal), 97 Type 9 (centrifugal), 262 Type X-29 (axial), and 101 Type 31 (axial) compressors, and 3 speed increases in the X-330 Evacuation Booster Station. Based on successful operation of these bearings, continued and expanded use of aluminum bearings recommended as a means of obtaining a high fatigue resistant bearing at a cost lower than that for babbitt-type bearings. Author (NSA)

N76-21568# University Coll. of Swansea (Wales). Swansea Tribology Centre.
MOLYBDENUM DISULPHIDE LUBRICATION. A CONTINUATION SURVEY 1973-1974
A. R. Lansdown [1975] 60 p refs
(Contract ESTEC-2261/74)
(STC-75/309; ESA-CR(P)-764) Avail: NTIS HC $4.50

A literature survey covering the state-of-the-art is presented. Topics covered include chemical and physical properties, lubrication mechanism, bonded films, incorporation in bulk solids, and use in oils and greases. One interesting development is an indication of the use of transfer film lubrication in the U.S.S.R.
ESA

N76-21569# Mitre Corp., McLean, Va.
ANALYSIS OF A COMBINED ATTRACTION-MAGLEV-PROPULSION SYSTEM FOR A HIGH SPEED VEHICLE
J. D. Muhlenberg and V. D. Nene Mar. 1975 50 p refs
(Contract DOT-FR-30015)
(PB-245189/6; MTR-6630; FRA/ORD-75/61) Avail: NTIS HC $4.00 CSCL 13F

The results are presented of a study of a combined levitation-propulsion system for a high speed ground transportation vehicle incorporating a single-sided linear induction motor as the levitation-propulsion unit. The system is first synthesized in accordance with design constraints and subsequently examined in detail. Time responses and rms values of various parameters of interest are calculated. The conclusion is that such a system is feasible and deserves further study. GRA

N76-21570# Naval Research Lab., Washington, D.C.
GREENHILL'S FORMULA AND THE MECHANICS OF CABLE HOCKLING Final Report
Felix Rosenthal 7 Nov. 1975 31 p refs
(NRL Proj. F02-24; RR0230345)
(AD-A018132; NRL-7940) Avail: NTIS CSCL 13/10

In the application of marine cables as tension members, serious structural failures have occurred as a result of hockling (forming of a loop under torsion combined with insufficient tension). This report endeavors to establish a criterion on end torques and forces for preventing hockling. It is shown that for rods in tension the torque corresponding to Greenhill's 100-year-old formula defining the onset of bending is also the maximum torque which can be sustained at that tension. Thus, a straight rod or cable loaded by tension and the Greenhill torque is unstable, and Greenhill's formula modified by an appropriate safety factor provides the desired no-hockle criterion. For long straight rods or cables under tension T and twisting moment M, this criterion for stability is M sq. - 4TEI, where EI is the bending stiffness under load. The approach used was to numerically solve in nondimensional form the two-point boundary-value problem of the rod under axial end torques and forces. The report includes curves showing torques and forces for the possible range of deflection curves. Author (GRA)

N76-21571# Northrop Corp., Hawthorne, Calif. Aircraft Div.
ANODIC ETCHING: A METHOD OF DETECTING GRINDING BURNS ON CHROMIUM PLATED STEEL PARTS
E. A. Lauchner and G. A. Andrews 7 Feb. 1975 39 p refs
(AD-A017689; NOR-75-33) Avail: NTIS CSCL 13/8

Anodic etching, a method for detecting abusive grinding damage on chromium plated steel parts, is evaluated. Anodic etching procedure for inspecting chromium plated steel pins was studied and the mechanism of the anodic etch burn indication is discussed. In addition, the results of magnetic particle and penetrant inspection of the pins is presented. The results indicate that abusive grinding of chromium plate can cause cracks or burns in the plate or base metal that are not detected by conventional inspection techniques. Anodic etching is a useful technique for determining if chromium plate has been burned by abusive grinding. If the plate is burned, further investigation is required to determine whether the base metal is burned or cracked. GRA

N76-21572# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
AN ANALYSIS OF EFFECTS OF ELECTROMECHANICAL VIBRATION ON SELECTED SPECIMENS Research Report, Nov. 1973 - Apr. 1975
N. R. Moody, W. H. Baer, and H. E. Horner Jun. 1975 29 p refs
(DA Proj. 1G7-62708-AH-67)
(AD-A018169; USAMERDC-2150) Avail: NTIS CSCL 13/8

An analysis of the effects of vibration on residual stress and distortion was performed on U-bend samples. Welded tensile specimens were also subjected to vibration to determine its effect on mechanical properties. A third test, subjecting a welded plate to vibration, was conducted to ascertain if these induced vibrations would cause crack nucleation and/or propagation. GRA

N76-21573# General Electric Co., West Lynn, Mass. Aircraft Engine Group.
AXIAL-CENTRIFUGAL COMPRESSOR PROGRAM
Lawrence W. Blair and David J. Tapparo Oct. 1975 275 p refs
(Contract DAAJ02-71-C-0050; DA Proj. 1G1-62207-AA-71)
(AD-A018078; USAAMRDL-TR-75-37) Avail: NTIS CSCL 13/7

This report presents the component test results and analysis for Phases 3, 4 and 5 of the 5-lb/sec axial-centrifugal compressor. Separate component tests were carried out to evaluate the two-stage axial compressor, the centrifugal compressor, and the combined axial-centrifugal compressor. Additional static blow tests were also conducted on the axial and centrifugal stage inlet guide vanes to determine their performance characteristics. The assembly procedure, buildup clearances, and test procedure are described herein, as well as the instrumentation, data reduction procedure, and test facilities. The test results are presented for all component tests carried out in this program as well as for tests from a related centrifugal compressor development program. The analysis of the test results are reported herein as well as recommendations for future development programs. This program demonstrated the feasibility of designing a 5-lb/sec, two-stage axial-centrifugal compressor in the 15:1 pressure ratio class and provided insight into the matching of axial-centrifugal compressors. Author (GRA)

N76-21574# General Electric Co., Schenectady, N.Y.
DEVELOPMENT OF A MINIATURE GAS-BEARING CRYOGENIC TURBO REFRIGERATOR Final Report, 15 Jan. 1971 - Oct. 1975
R. B. Fleming, D. B. Colyer, R. K. Terbush, B. B. Gamble, and R. O. Gney Oct. 1975 231 p refs
(Contract DAAK02-71-C-0026)
(AD-A018047; SRD-75-097) Avail: NTIS CSCL 13/1

The type of system investigated used the Claude cycle for the production of refrigeration at 4.4K. Temperatures at this level are suitable for numerous applications of superconductivity. A distinguishing feature of the equipment under development is the use of high-speed dynamic compressors and turboalternators, in which all rotating parts are suspended on self-acting gas bearings. Such a system avoids sliding contact and wear during operation and avoids the contamination problems associated with oil lubricated compressors used in conventional cryogenic refrigerators. The work described was directed finally to the development of a system consisting of three cryogenic turboalternators, six helium centrifugal compressor stages, and a cryogenic heat exchanger with seven heat exchanger modules. Work was limited to the turboalternators and heat exchangers. A cryogenic turboalternator was developed and successfully tested to temperatures in the range of 80 to 100K. GRA

N76-21575# Radio Corp. of America, Burlington, Mass. Government Communications and Automated Systems Div.
MANUFACTURING METHODS AND TECHNOLOGY PROGRAM AUTOMATED IMAGE DEVICE EVALUATOR (AIDE) Quarterly Progress Report, 1 Apr. - 30 Jun. 1975
E. W. Ketler 30 Jun. 1975 34 p
(Contract DAAB05-74-C-2524)
(AD-A016976; QPR-6) Avail: NTIS CSCL 09/1

The purpose of this contract is to establish a manufacturing method and technology program for an Automated Image Device Evaluator (AIDE) which will provide a computer controlled test system capable of performing production acceptance testing of second generation image intensifier tubes at the manufacturer's plant. The report covers the work performed on the AIDE equipment task during the period 1 April - 30 June 1975. It presents a technical and physical description of the Development Model equipment design and configuration. GRA

N76-21576# Research Triangle Inst., Research Triangle Park, N.C.
RANN UTILIZATION EXPERIENCE. CASE STUDY NO. 5: AUTOMATED BEAM BENDER
R. P. Donovan 1975 30 p refs Prepared in part by Case Western Reserve Univ.
(Contract NSF C-927)
(PB-247249/6; NSF/RA/G-75-033) Avail: NTIS HC $4.00 CSCL 13J

The objective of this research was to develop a computer-

controlled method for the cold forming of ship frames, i.e., large steel beams. The approach taken was to develop a bench scale model of a beam-bending apparatus that can shape ship frames by applying pure bending moment to the members and eliminate out-of-plane deformation by computer routines that correct incipient errors detected during the bending. Successful completion of the project can potentially revitalize the ailing U.S. shipbuilding industry by vastly reducing the costly customization process, thereby reducing the costs of shipbuilding. From this project the Maritime Administration expects to obtain specifications for a large-scale beam bender. Overall, project utilization is significant in that a federal agency, the Maritime Commission, is using the research results; in addition, attitudes of industry are being modified through awareness of the ultimate potential of the techniques being developed. GRA

N76-21577# Massachusetts Univ., Amherst. Dept. of Mechanical and Aerospace Engineering.
GROUP TECHNOLOGY APPLIED TO THE AUTOMATIC HANDLING OF SMALL PARTS Progress Report
G. Boothroyd, C. R. Poli, and L. E. Murch 1 Feb. 1975 47 p refs
(Grant NSF ATA-74-12611)
(PB-247268/6; NSF/RA/T-75-042; PR-1) Avail: NTIS HC $4.00 CSCL 13H

A comprehensive manual suitable for industrial use, describing feeding and orienting techniques for small parts is developed. The manual is being gradually assembled and consists of individual data sheets and a part coding system. Examples of the coding system and the data sheets already developed are presented. GRA

N76-21578# American Society of Mechanical Engineers, New York.
ASME REPORT ON CHEMICAL EFFECTS OF LUBRICATION IN CONTACT FATIGUE Summary Report, 1 Sep. 1970 - 31 Oct. 1974
S. Bhattacharyya, M. A. H. Howes, F. C. Bock, and N. M. Barikh Nov. 1975 174 p refs
(PB-247388/2; ASME/RCL-1975/1) Avail: NTIS HC $6.75 CSCL 13I

Lubricant chemical factors exert significant influence on the contact fatigue life of materials used in gears and rolling contact bearings. Geared roller test machines using 3.3 and 30% slip, low and high viscosity mineral oils and synthetic polyolester base stocks, were used to carry out tests at 1400 and 2800 rpm on ground, honed, and polished surface specimens of 52100 and 8620 carburized steels. Statistical test design and analysis showed lubricant chemistry effect varying with stress and slip; chemistry of lubricant base stock and additives affect fatigue life level, stress/life slope and Weibull slope. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N76-21579*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
ACCELERATED TEST TECHNIQUES FOR MICROCIRCUITS: EVALUATION OF HIGH TEMPERATURE (473 K - 573 K) ACCELERATED LIFE TEST TECHNIQUES AS EFFECTIVE MICROCIRCUIT SCREENING METHODS Final Technical Report, Jul. 1973 - Dec. 1974
G. M. Johnson 24 Jan. 1976 78 p refs
(Contract NAS5-22233)
(NASA-CR-144741; MDC-E1208) Avail: NTIS HC $5.00 CSCL 14D

The application of high temperature accelerated test techniques was shown to be an effective method of microcircuit defect screening. Comprehensive microcircuit evaluations and a series of high temperature (473 K to 573 K) life tests demonstrated that a freak or early failure population of surface contaminated devices could be completely screened in thirty two hours of test at an ambient temperature of 523 K. Equivalent screening at 398 K, as prescribed by current Military and NASA specifications, would have required in excess of 1,500 hours of test. All testing was accomplished with a Texas Instruments' 54L10, low power triple-3 input NAND gate manufactured with a titanium-tungsten (Ti-W), Gold (Au) metallization system. A number of design and/or manufacturing anomalies were also noted with the Ti-W, Au metallization system. Further study of the exact nature and cause(s) of these anomalies is recommended prior to the use of microcircuits with Ti-W, Au metallization in long life/high reliability applications. Photomicrographs of tested circuits are included. Author

N76-21580# Failure Analysis Associates, Palo Alto, Calif.
INSPECTION UNCERTAINTY, THE KEY ELEMENT IN NONDESTRUCTIVE INSPECTION
D. P. Johnson May 1975 30 p refs Sponsored by Elec. Power Res. Inst.
(PB-246252/1; FAA-75-1; EPRI-217-1-TR-1) Avail: NTIS HC $4.00 CSCL 18I

This paper identifies the inspection uncertainty, which is a measure of the difference between the size of imperfection that has a high probability of being passed and the size of imperfection that has a high probability of being rejected by an inspection, as the primary measure of an inspection method, rather than the inspection sensitivity as is often suggested. Reduction of the inspection uncertainty is the only means by which one can simultaneously reduce both type one inspection errors, rejection of sound material units. The discussion is presented within a framework that allows a quantitative evaluation of the quality of the material units that pass an inspection and a determination of the rejection rate. Analysis of the causes of inspection uncertainty is essential to efficient strategies for improving nondestructive inspection capabilities. GRA

N76-21581# Failure Analysis Associates, Palo Alto, Calif.
COST-RISK OPTIMIZATION OF NONDESTRUCTIVE INSPECTION LEVEL
D. P. Johnson Sep. 1975 53 p refs Sponsored by Elec. Power Res. Inst.
(PB-246256/2; FAA-75-4-9; EPRI-217-1-TR-5) Avail: NTIS HC $4.50 CSCL 18I

A quantitative methodology for determining the nondestructive inspection (NDI) level that will result in a minimum cost product considering both type one inspection errors, acceptance of defective material units, and type two inspection errors, rejection of sound material units. This methodology represents an advance over fracture mechanics - nondestructive inspection (FM-NDI) design systems that do not consider type two inspection errors or the pre-inspection material quality. Four methods are identified for determining the flaw-frequency and three methods are identified for determining the conditional failure probability (one of these methods is probabilistic fracture mechanics). Methods for determining the rejection probability are discussed elsewhere. The NDI-FF methodology can have significant impact when the cost of failures represents a significant fraction of the manufacturing costs, or when a significant fraction of the components is being rejected. GRA

N76-21582# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
WEAR TESTING FOR EROSIVE WEAR
F. G. Hammitt Sep. 1975 33 p refs Presented at the Symp. on Selection and Use of Wear Tests for metals, New Orleans, 20 Nov. 1975 Sponsored in part by the Alcoa Foundation
(Grant NSF G-40130)
(PB-246744/7; UMICH-012449-21-1) Avail: NTIS HC $4.00 CSCL 14B

Fluid-induced erosion, single and multiphase flow is considered according to the various phenomena involved. The basic damage mechanisms are considered and described. The various types of erosion testing devices are described and compared. GRA

N76-21583# National Bureau of Standards, Washington, D.C. Center for Consumer Product Technology.
CHARACTERIZATION OF SHARP POINTS AND EDGES BY

ELECTRICAL BREAKDOWN Final Report
Julius Cohen Aug. 1975 21 p refs
(PB-247270/2; NBSIR-75-908) Avail: NTIS HC $3.50 CSCL 13L

Experiments were made to determine the feasibility of using the phenomenon of electrical breakdown in air to characterize sharp metallic edges and points. It was hoped that the technique might be useful to detect sharp edges or points in some consumer products. A fixed voltage was applied between a sample edge or point and a parallel plane, and threshold gap length for breakdown observed. Results were quite favorable for edges, but not for points, and the polarity on the samples was required to be negative. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N76-21584 Engineering Sciences Data Unit, London (England).
NATURAL FREQUENCIES OF RECTANGULAR FLAT PLATES WITH VARIOUS EDGE CONDITIONS
Nov. 1975 52 p Supersedes ESDU-66019
(ESDU-75030) For information on availability of series, sub-series and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $578.50

This report presents data in graphical form for calculating the natural frequencies of flat isotropic rectangular plates for modes up to at least (3,1) and (1,3). It covers all the 36 possible combinations of free, simply-supported and clamped edge conditions, and a method is provided to allow the estimation of natural frequencies of plates under the action of uniform biaxial in-plane loads. Each combination of edge conditions is dealt with on a single graph which presents a non-dimensional frequency coefficient which avoids either very large or very small values. The report covers any respect ratio and so allows the natural frequencies of beams to be estimated within certain stated limitations. The data are presented for the commonly used engineering materials which have a Poisson's ratio of 0.3 and guidance is provided on the effect of departure from this value in other materials. An appendix to the report provides approximate data for calculating buckling stresses under biaxial loading for plates with most of the possible combinations of edge conditions. These buckling loads are required to estimate the effect of in-plane loading on natural frequencies. ESDU

N76-21585 Engineering Sciences Data Unit, London (England).
INITIAL BUCKLING OF SQUARE PLATES IN SHEAR WITH CENTRAL FLANGED CIRCULAR HOLES
Nov. 1975 4 p
(ESDU-75035) For information on availability of series, sub-series and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $50.50

This report deals with the design of square or nearly square plates subjected to shear and containing a central circular hole. It is concerned with the elastic buckling of plates with holes with flanged or reinforced edges. ESDU

N76-21586 Engineering Sciences Data Unit, London (England).
INITIAL BUCKLING STRESS, MAXIMUM DIRECT STRESS AND SHEAR STRAIN OF SQUARE PLATES IN SHEAR WITH CENTRAL CIRCULAR HOLES
Nov. 1975 4 p
(ESDU-75034) For information on availability of series, sub-series and other individual data items, write NTIS, Attn: ESDU, Springfield, Va. 22161. HC $50.50

The report provides the maximum direct stress, initial elastic buckling stress and shear strain for flat square plates containing a central circular hole when the plate is subjected to in-plane shear loading. ESDU

N76-21587*# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. Mechanics and Engineering Systems Dept.
BIFURCATION AND COLLAPSE ANALYSIS OF STRINGER AND RING-STRINGER STIFFENED CYLINDRICAL SHELLS WITH CUTOUTS
A. N. Palazotto [1975] 41 p refs
(Grant NGR-07-001-004)
(NASA-CR-146777) Avail: NTIS HC $4.00 CSCL 13M

Results for cylindrical configurations using the STAGS computer program were presented. Discontinuities were imposed upon the shell's skin by incorporating symmetrical cutout openings. In addition, the surface is stiffened with both stringer and ring-stringer arrangements. The cutout problem has been shown to be highly nonlinear for smooth surface shells, but it was found that bifurcation and collapse loads are close when one is considering stiffened skin configurations. In order to arrive at this conclusion, it was necessary to evaluate the following: (1) comparison between smeared and discrete stiffener theory for linear solutions, (2) numerical finite difference convergence as directed toward buckling determination, (3) collapse load results with the various skin stiffeners. A linear bifurcation study relating to stiffening effects around cutout areas present within stringer and ring-stringer shell surfaces was included. Comparisons were made between a variety of geometric positions considering cutout frame and thickened skin additions. Author

N76-21588*# Kanner (Leo) Associates, Redwood City, Calif.
STATIC METHODS OF TESTING REINFORCED PLASTICS
Yu. M. Tarnopolskiy and T. Ya. Kintsis Washington NASA Apr. 1976 286 p refs Transl. into ENGLISH of the book "Metody Statist. Ispytaniy Armirovannykh Plastikov" Moscow, Khim. Press, 1975 p 3-263
(Contract NASw-2790)
(NASA-TT-F-16669) Avail: NTIS HC $9.25 CSCL 13M

General information is presented on composite materials and property characteristics of reinforced plastics, to include anisotropy of composites, elastic and strength properties, and various operational, structural and technological factors affecting those properties. Separate chapters are devoted to tensile, compression and crushing, shear and bending tests, with detailed information in each on test conditions and relationships, sample shape and size and test techniques and methods. A separate chapter is devoted to testing of rings and pipe. Detailed summary tables are provided on tests of each of the properties discussed, as well as on testing rings and pipe. Author

N76-21589*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VIBRATION CHARACTERISTICS OF COMPOSITE FAN BLADES AND COMPARISON WITH MEASURED DATA
C. C. Chamis 1976 12 p refs Presented at 17th Struct., Structural Dyn. and Mater. Conf., King of Prussia, Penna., 5-7 May 1976; sponsored by Am. Inst. of Aeron. and Astronautics, Am. Soc. of Mech. Engr., and Soc. of Autom. Engr.
(NASA-TM-X-71893) Avail: NTIS HC $3.50 CSCL 13M

The vibration characteristics of a composite fan blade for high-tip-speed applications were determined theoretically and the results compared with measured data. The theoretical results were obtained using a computerized capability consisting of NASTRAN coupled with composite mechanics by way of pre- and postprocessors. The predicted vibration frequencies and mode shapes were in reasonable agreement with the measured data. Theoretical results showed that different laminate configurations from the same composite system had only small effects on the blade frequency. However, the use of adhesively bonded titanium/beryllium laminar composites may improve considerably the blade vibration characteristics. Author

N76-21590# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
QUASILINEAR ANALYSIS AND TESTING OF ECCENTRICALLY STIFFENED ANNULAR PLATES IN COMPRESSION
A. Libai, M. Feder, and A. Rosen Jan. 1976 62 p refs Sponsored by Israel Min. of Defense
(TAE-269) Avail: NTIS HC $4.50

The behavior of an annular plate which is compressed along its outer boundary and eccentrically reinforced along its inner boundary is investigated both analytically and experimentally. The eccentricity couples the in-plane and bending deformations so that although small deflection plate theory is used, typical nonlinear

modes of behavior are displayed. The theory provides a transitional quadratic range between the strictly linear theory and the stronger cubic nonlinearity of the Von-Karman plate. A method for the explicit solution of the equations is presented. An experimental program accompanied the analytical study, giving qualitative and quantitative supporting results. Good correlation was obtained.
Author

N76-21591*# Old Dominion Univ. Research Foundation, Norfolk, Va.
THERMAL-STRUCTURAL ANALYSES OF A SCRAMJET FUEL INJECTION STRUT Final Report, Sep. 1974 - Dec. 1975
Earl A. Thornton (Old Dominion Univ.) Mar. 1976 23 p refs (Grant NsG-1093)
(NASA-CR-146839; TR-76-M3) Avail: NTIS CSCL 13M

Two-dimensional thermal/structural analyses of a scramjet fuel injection strut are described. The strut is subjected to aerodynamic heating on two sides and is internally cooled by hydrogen flowing from internal manifolds through heat exchangers bonded to the primary structure. A nonlinear steady-state thermal analysis was first performed using the NASTRAN finite element thermal analyzer. Coolant temperatures were supplied to NASTRAN from a thermal analysis performed using MITAS, a finite difference thermal analyzer. The NASTRAN finite element model was then used to perform a plane strain structural analysis for the strut subjected to: (1) thermal loads, (2) loads from internal pressures, and (3) combined thermal and pressure loads. The thermal analysis showed that temperatures vary considerably over the strut cross section with severe temperature gradients through the walls of the primary structure. The structural behavior due to the thermal and mechanical loadings closely resembled the membrane-bending action characteristic of thin-walled pressure vessels. Significant wall bending occurred due to wall thermal gradients and the constraining effects of internal bulkheads. Thermal stress accounted for about two-thirds of the maximum combined stress (460 MPa, 65 ksi) due to thermal and pressure loads.
Author

N76-21592*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
THREE-DIMENSIONAL FINITE ELEMENT ANALYSIS FOR HIGH VELOCITY IMPACT Interim Report, Jun. 1974 - Jun. 1975
S. T. K. Chan, C. H. Lee, and M. R. Brashears Aug. 1975 160 p refs
(Contract NAS3-18908)
(NASA-CR-134933; LMSC-HREC-TR-D390900) Avail: NTIS HC $6.75 CSCL 13M

A finite element algorithm for solving unsteady, three-dimensional high velocity impact problems is presented. A computer program was developed based on the Eulerian hydroelasto-viscoplastic formulation and the utilization of the theorem of weak solutions. The equations solved consist of conservation of mass, momentum, and energy, equation of state, and appropriate constitutive equations. The solution technique is a time-dependent finite element analysis utilizing three-dimensional isoparametric elements, in conjunction with a generalized two-step time integration scheme. The developed code was demonstrated by solving one-dimensional as well as three-dimensional impact problems for both the inviscid hydrodynamic model and the hydroelasto-viscoplastic model.
Author

N76-21593# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE DEPENDENCE OF THE CRITICAL LOADS ON THE LOADING HISTORY OF ELASTIC-PLASTIC PLATES
V. D. Kliushnikov [1975] 8 p refs Transl. into ENGLISH of the book "Mekhanika Deformiruemykh Tel i Konstruktsii" Moscow, Mashinostr., 1975 p 220-226
Avail: NTIS HC $3.50; National Translations Center, John Crerar Library, Chicago, Illinois 60616

The loading of an elastic plate in its plane is discussed in terms of the strain, which is independent of the loading method. Starting with an idealized plate model consisting of two parallel square plates, deformable in their planes, the loading path and the total strain increment are found for each plate. The plasticity and translational hardening are shown to be essential for predicting the behavior of plates under loading.
F.O.S.

N76-21594# California Univ., Berkeley. Structural Engineering Lab.
STRESS OF TEE JOINTS BY THE FINITE ELEMENT METHOD
A. N. Gantayat and G. Powell Feb. 1973 248 p refs Prepared for ORNL Sponsored by ERDA
(ORNL-SUB-3193-1) Avail: NTIS HC $9.00

A series of three computer programs for the stress and thermal stress analysis of tee joints to ASA B16.9 is described. Detailed user's guides to the programs are presented, and the results of analyses are compared with experimental measurements obtained elsewhere. An investigation to select the most appropriate finite element for inclusion in the programs is described. The finite element theory, for both stress and transient heat flow analysis, is presented in detail. Listings of input data for sample problems are included. It is concluded that results in good agreement with experiment can be obtained, but that further studies of the effects of mesh refinement remain to be carried out.
Author (NSA)

N76-21595# Los Alamos Scientific Lab., N.Mex.
PRESTRESSED CONCRETE REACTOR VESSELS: REVIEW OF DESIGN AND FAILURE CRITERIA
E. G. Endebrook Mar. 1975 9 p refs
(Contract W-7405-eng-36)
(LA-5902-MS) Avail: NTIS HC $4.00

The design and failure criteria of prestressed concrete reactor vessels (PCRVs) are reviewed along with the analysis methods. The mechanical properties of concrete under multiaxial stresses are not adequately quantified or described to permit an accurate analysis of a PCRV. Structural analysis of PCRVs almost universally utilizes a finite element which encounters difficulties in numerical solution of the governing equations and in treatment of fractured elements.
Author (NSA)

N76-21596# Danish Atomic Energy Commission, Risoe.
DYNAMIC ANALYSIS OF AIRCRAFT IMPACT USING THE LINEAR ELASTIC FINITE ELEMENT CODES FINEL, SAP, AND STARDYNE
P. Lundsager and S. Krenk 28 Aug. 1975 18 p refs
(RISO-M-1817) Avail: ERDA Depository Libraries HC $4.00

The static and dynamic response of a cylindrical/spherical containment to a Boeing 720 impact was computed using 3 different linear elastic computer codes. Stress and displacement fields are shown together with time histories for a point in the impact zone. The main conclusions from this study are: (1) the maximum dynamic load factors for stress and displacements were close to 1, but a static analysis alone is not fully sufficient; (2) more realistic load time histories should be considered; (3) the main effects seem to be local and the present study does not indicate general collapse from elastic stresses alone; and (4) further study of material properties at high strain rates is needed.
Author (NSA)

N76-21597# Bristol Univ. (England). Dept. of Aeronautical Engineering.
INTERCELL BUCKLING OF HONEYCOMB-CORE SANDWICH PANELS
R. H. Luckin-Smith and D. J. Thomas Jun. 1974 53 p refs
(BU-174) Avail: NTIS HC $4.50

A theoretical and experimental investigation into the intercell buckling of sandwich panels with carbon fiber reinforced plastic faceplates and honeycomb cores when loaded in compression is presented. Simplified theoretical analyses were made assuming both simply supported and clamped edge conditions at the cell walls, and an attempt was made to verify the results for different layups of the carbon fiber faces. Experimental results agree quite well with the theory but show that the edge conditions at the cell walls are probably those of simple support and clamped. The use of strain gages to detect the onset of buckling gave only approximate results, and it was felt that more accurate work could be done using dial gages.
Author (ESA)

N76-21598# Bristol Univ. (England). Dept. of Aeronautical Engineering.
AN INVESTIGATION INTO THE BEHAVIOUR OF SUPERPLASTICALLY FORMED CORRUGATED SHEAR WEBS
K. J. Dunn and D. Webb Jun. 1974 52 p refs

(BU-177) Avail: NTIS HC $4.50

The shape of a corrugated shear web giving the maximum buckling load for a given weight of material was determined. The corrugation shape considered were restricted to segments of a circular arc, the radius of the arc being determined by maintaining the same second moment of area for each shape. A theory was developed from published work on the shear buckling of curved panels, and this indicated an optimum corrugation composed arc segments with an included half angle of 63 deg. One flat and three corrugated webs were tested but, because of imperfections in the forming, only the flat plate buckled. It was not possible, therefore, to either confirm or disprove the theory. Author (ESA)

N76-21599# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).

FATIGUE INVESTIGATION OF HIGHER STRENGTH STRUCTURAL STEELS IN NOTCHED AND IN WELDED CONDITION. SYNTHESIS OF RESULTS AND TENTATIVE CONCLUSIONS

E. Haibach and R. Olivier May 1974 25 p refs Sponsored by the Communaute Europeenne du Charbon et de l'Acier

(LBF-TB-114/74) Avail: NTIS HC $3.50

A common research program, in which seven European laboratories and three welding institutes participated, was aimed at normalized steels of type Fe E 355 and Fe E 460. Notched specimens (Kt = 2.5) and typical fillet welded joints (non load carrying fillets welded in flat and vertical position, and fillet welded cruciform joints) were tested under alternating, zero-tension, and fluctuating tension constant amplitude loading. The investigation was completely based on statistical test plans and yielded results of high homogeneity and reliability. Author (ESA)

N76-21600# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).

A STATISTICAL RE-ANALYSIS OF FATIGUE TEST RESULTS ON WELDED JOINTS IN AlMg5. DESCRIPTION OF THE PROCEDURE AND DOCUMENTATION OF THE EVALUATED TEST SERIES.

E. Haibach and B. Atzori Dec. 1974 199 p refs Sponsored in part by NATO

(LBF-FB-116/74) Avail: NTIS HC $7.50

Published fatigue data for typical kinds of welded joints in AlMg 5, AlMg 4.5Mn, and similar aluminum alloys, comprising a total of 79 test series and 1274 individual results, were re-analyzed on a statistical basis. All constant amplitude S-N test series analyzed so far may be described by a unified scatter band. In combination with the unified scatter band, the fatigue strength of each test series is defined by a characteristic stress amplitude that is read from the mean curve (Ps = 0.5) at N sub A = 2 megacycles. There is a reasonable scatter of the characteristic stress amplitudes of the test series referring to the same kind of joints and to the same stress ratio; however, a scatter range of T = 1:1.4 was found to apply in general to the grouped values of stress amplitudes independent of the kind of joint and of the stress ratio. Although there are several effects for which it is not yet possible to give an explanation, the performed analysis provides some statistically significant design data and a more systematical insight into the fatigue characteristics of welds in AlMg 5 and similar materials. In addition to the description of the applied procedure and of the results, a complete documentation of all evaluated test series is given. Author (ESA)

N76-21601# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).

REVIEW OF INVESTIGATIONS ON AERONAUTICAL FATIGUE IN THE FEDERAL REPUBLIC OF GERMANY, JULY 1973 - APRIL 1975

O. Buxbaum Apr. 1975 169 p refs Presented at the 14th Conf. of the Intern. Comm. on Aeron. Fatigue, Lausanne, Switz., 1975

(LBF-S-119) Avail: NTIS HC $6.75

Work carried out in the field of fatigue of aircraft structures is reviewed. Topics covered include the measurement and analysis of operational loads, fatigue tests under random or randomized sequences, the fatigue behavior of notched specimens and joints, cyclic stress-strain behavior and low cycles fatigue, crack propagation, fracture mechanics, and residual static strength. ESA

N76-21602# Sydney Univ. (Australia). Civil Engineering Labs.

EXPERIMENTS ON EXTERNAL COLUMN CONNECTIONS IN COMPOSITE FRAMES

P. Ansourian and J. W. Roderick Jun. 1975 57 p

(PB-245329/8; R-266) Avail: NTIS HC $4.50 CSCL 13M

Tests are described on ten specimens representative of beam-to-column connections at exterior columns of rigid frames. Three of the specimens are of bare steel and seven of composite construction. The columns are all of I-section bent about the major axis, and are encased in plain concrete to a minimum cover of 50mm. The composite beams are of T-section and the shear connection is made with welded studs. The steel core components are attached using typical welded connections. It is shown that composite action can be realized in the beam at the face of the column, and assessment has been made of the contribution of the column casing to the rigidity of the connection. GRA

N76-21603# Sydney Univ. (Australia). Civil Engineering Labs.

AN APPLICATION OF THE METHOD OF FINITE ELEMENTS TO THE ANALYSIS OF COMPOSITE FLOOR SYSTEMS

P. Ansourian Mar. 1975 50 p refs

(PB-245330/6; R-262) Avail: NTIS HC $4.00 CSCL 13M

Thin-shell type elements are applied to a study of full composite action between concrete slabs and steel joists in the elastic range. The principal variable of the study is the ratio of the flexural stiffness of the joist and slab. The form and magnitude of the errors inherent in the use of simple T-beam theory using two different effective widths are examined. A comparison of theoretical results is made with the observed behavior at loads below cracking of composite beam-to-column connection specimens. GRA

N76-21604# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

EXPERIMENTAL INVESTIGATION OF NATURAL FREQUENCIES OF PLATES WITH VARIABLE THICKNESS M.S. Thesis

John W. Horwat Jun. 1975 81 p refs

(AD-A018158; GCE/MC/74-14) Avail: NTIS CSCL 20/11

Experiments to determine the first four natural frequencies and mode shapes of vibrating plates of variable thickness were carried out. The specimens consisted of circular plates with circular cutouts of given radius with centers at various distances from the plate center, square plates with concentric circular cutouts with varying radii, a square plate with a double thickness, step and tapered plates with varying taper ratios. The experimental methods consisted of shaker testing with accelerometer sensing, and acoustic excitation with laser holographic interferometry. The variation of frequency, and mode shape with cutout location was investigated in both experiments. GRA

N76-21605# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.

INFLUENCE OF ASYMMETRIC IMPERFECTIONS ON THE VIBRATIONS OF AXIALLY COMPRESSED CYLINDRICAL SHELLS Interim Report

Aviv Rosen and Josef Singer Mar. 1973 82 p refs

(Contract F44620-71-C-0116; Grant AF-AFOSR-2394-72; AF Proj. 9782)

(AD-A017682; TAE-212; AFOSR-75-1485TR) Avail: NTIS CSCL 20/11

The influence of two types of asymmetric initial geometrical imperfections on the vibrations and buckling of axially loaded isotropic cylindrical shells is studied. The analysis is based on a solution of the Karman-Donnell nonlinear shell equations by the Galerkin method. The results indicate that the influence of the initial geometrical imperfections depends strongly on the mode of the initial imperfection and its relation to the mode of vibration. The imperfections may lower or raise the frequency. The buckling loads also depend strongly on the relation between the corresponding modes. In general, a reduction in buckling load is predicted, but in some cases the solution predicts an

increase in buckling loads due to imperfections and in certain cases even large bending deformation without buckling. GRA

N76-21606# Polytechnic Inst. of New York, Brooklyn. Dept. of Aerospace Engineering and Applied Mechanics.
DYNAMIC RESPONSE OF AN OVAL RING
Y. N. Chen and W. R. Yetman, Jr. Jul. 1975 44 p refs
(Contract F44620-74-C-0047; AF Proj. 6813; AF Proj. 9782)
(AD-A017869; POLY-AE/AM-75-9; AFOSR-75-1534TR) Avail: NTIS CSCL 20/11

The response of oval rings of varying eccentricity for several types of applied loading conditions have been obtained. It is found that the magnitude as well as the frequency of oscillation of the deflection is dependent upon the ring eccentricity. In addition, the dependence of the deflection upon circumferential position is shown to be related to the local radius of curvature. Other results include the determination of the resonance frequencies of the ring as well as the existence of a double resonance 'peak' observed via the classic 'beat' phenomenon. GRA

N76-21607# California Univ., La Jolla. Dept. of Applied Mechanics and Engineering Sciences.
NOTE ON A PROBLEM OF BEAM BUCKLING Interim Report
G. E. Lee and E. Reissner Oct. 1975 9 p
(Contract N00014-75-C-0158)
(AD-A018186) Avail: NTIS CSCL 20/11

The report describes formulation and solution of a problem of classical beam buckling, with interesting properties in regard to the difference between direction-fixed and tangential load. GRA

N76-21608# Aeronautical Research Associates of Princeton, Inc., N.J.
THEORY EXTENSION AND NUMERICAL EXPERIMENTS TO DETERMINE THE PROBABILITY OF EXCEEDANCE OF GIVEN LOAD LEVELS IN SPECIFIED TIMES Final Report
John C. Houbolt Aug. 1975 29 p refs
(Contract F44620-71-C-0022; AF Proj. 6813; AF Proj. 9782)
(AD-A017680; ARAP-253; AFOSR-75-1528TR) Avail: NTIS CSCL 13/13

Extensions to the theory of the 'first encounter' problem are developed. Numerical experiments with actual time histories were conducted to establish the probability density distribution functions for the intervals between like crossings. Time histories considered include a random function, vertical acceleration records due to gust encounter, and vertical gust velocities of continuous atmospheric turbulence. It appears that the density distribution function for practical cases can be represented well by two exponential terms (a single term applies to a time sequence of independent events). The associated curves giving the probability of encountering a given level of the phenomenon under consideration in a specified time are developed. Examples are given to show application in the gust loads encounter problem. GRA

N76-21609# California Univ., San Diego. Dept. of Applied Mechanics and Engineering Sciences.
ON THE THEORY OF TRANSVERSE BENDING ELASTIC PLATES
E. Reissner Oct. 1975 25 p refs
(Contract N00014-75-C-0158)
(AD-A017771) Avail: NTIS CSCL 13/13

Departing from a self-contained two-dimensional formulation of the linear theory problem of transverse bending plates, three distinct topics are considered. The first of these concerns the integration problem for the case of orthotropy, specifically in regard to the factorization of a certain sixth-order master-equation. The second topic concerns the boundary layer aspects of contracted or reduced boundary conditions for the interior solution contribution for the case of isotropic plates. The analysis of this is based on a new form of the well known general solution in terms of a deflection and a stress function variable, with this new form making it possible to distinguish between first- and second-order transverse shear deformation effects; the former being associated with the edge zone and the latter with the interior domain of the plate, with the shear correction terms for the interior being generalizations of the Timoshenko shear correction terms for beams. The third topic is a new system of contracted boundary conditions, both for the stress and for the displacement boundary value problem, in such a way that first-order transverse shear deformation effects are explicitly incorporated in the interior-domain solution contribution, without the necessity of a simultaneous determination of the edge-zone solution contribution. Author (GRA)

N76-21610# California Univ., La Jolla. Dept. of Applied Mechanics and Engineering Sciences.
ON THE DETERMINATION OF STRESSES AND DEFLECTIONS FOR ANISOTROPIC HOMOGENEOUS CANTILEVER BEAMS
S. Nair and E. Reissner Jan. 1975 25 p refs
(Contract N00014-75-C-0158)
(AD-A017809) Avail: NTIS CSCL 20/11

The effect of anisotropy on beam flexibility is analyzed by the derivation of upper and lower bounds, through use of the principles of minimum potential and complementary energy, for the load-deflection ratios of narrow rectangular cross section cantilever beams. The basic assumption is a class of stress-strain relations of such nature that normal strains are caused not only by normal stresses but also by shearing stresses, and shearing strains are caused not only by shearing stresses but also by normal stresses. GRA

N76-21611# Watervliet Arsenal, N.Y.
A HYBRID METHOD FOR CRACK STRESS ANALYSIS: MAPPING COLLOCATION COMBINED WITH FINITE ELEMENT
Julian J. Wu Jan. 1975 33 p refs
(AD-A017757; WVT-TR-75057) Avail: NTIS CSCL 20/11

A new method for crack stress analysis has been developed by combining the modified mapping collocation method and the finite element method. The method of analytic stress functions of a complex variable is used for the immediate region around the crack tip. For regions away from the crack tip, where the stress function representation becomes ineffective or where the boundary becomes irregular, the finite element approach is used. At the junction between the collocation and the finite element regions, stress and/or displacement continuity conditions are implemented. The procedures involved are illustrated in the solutions of typical crack problems. It is demonstrated that this new algorithm is very powerful for solutions of crack stress problems with a wide range of geometric varieties. Finally, the numerical results for the sample problems are compared with the known data from the existing literature. GRA

N76-21612# Federal Highway Administration, Arlington, Va. Demonstration Projects Div.
CONCRETE COVER STUDY Final Report
Jonathan R. VanDaveer and Gordon D. Sheret Sep. 1976 66 p refs
(PB-248106/7; FHWA-DP-15) Avail: NTIS HC $4.50 CSCL 13C

The Federal Highway Administration measured the clear cover over the top mat of bridge deck reinforcing steel. Typically of the bridges tested, the average concrete cover depth exceeded design requirements. However, because the cover depth distribution is near normal, a significant portion of the deck (approximately 30 percent) has less than design cover. Those bridges that met design cover requirements by 100 percent have an average cover depth approximately 3/4-inch (19mm) greater than design. Design and construction practices were compared with the field measurement results to determine if a correlation exists between these practices and cover depth. No single practice was found to contribute significantly to cover depth deviating from design depth. GRA

N76-21613# Transportation Research Board, Washington, D.C.
BITUMINOUS MIXTURES, AGGREGATES, AND PAVEMENTS
Ralph Haas 1975 68 p refs Sponsored in cooperation with NSF
(PB-247319/7; TRB/TRR-549; ISBN-0-309-02454-4) Avail: NTIS HC $4.50 CSCL 13C

Cyclic creep of bituminous materials under transient,

high-volume loads; fatigue behavior of conventional and rationally designed bituminous mixes on simulated subgrade; recommended procedure for determining the dynamic modulus of asphalt mixtures; temperature distributions in asphaltic concrete pavements; a preliminary investigation of the feasibility of spent oil shale as road construction; design considerations for a direct-fired propane heater to preheat the base for cold-weather paving.
GRA

N76-21614# Transportation Research Board, Washington, D.C.
CONCRETE AND STEEL BRIDGES
1975 80 p refs Presented at 54th Ann. Meeting, Transportation Res. Board, Washington, D. C.
(PB-247320/5; TRB/TRR-547; ISBN-0-309-02452-8) Avail: NTIS HC $5.00 CSCL 13M

Contents: design of bent caps for concrete box-girder bridges; curved I-girder design; thermal stresses in concrete bridge superstructures under summer conditions; direct method for estimating prestress losses; field tests of a steel-composite box-girder bridge; laboratory evaluation of full-size, elastomeric, bridge bearing pads; IRIS-an information retrieval system for bridge inventory maintenance; and bridge pier staining. GRA

N76-21615# National Bureau of Standards, Washington, D.C. Materials and Composites Section.
NONDESTRUCTIVE TESTS TO DETERMINE CONCRETE STRENGTH, A STATUS REPORT Final Report
James R. Clifton Jul. 1975 39 p refs
(PB-246858/5; NBSIR-75-729) Avail: NTIS HC $4.00 CSCL 13C

Individual and combined nondestructive test methods have been critically reviewed as potential methods to determine safe formwork removal times. The techniques reviewed are the Windsor probe, the Schmidt Rebound Hammer, pull-out measurements, push-out cylinders, ultrasonic pulse velocity measurements, and the maturity and equivalent age concepts. The individual methods, themselves, do not give good estimates of the in situ strengths of concretes and it is recommended that future research emphasize combined methods. A proposed research program which emphasizes combined nondestructive test methods has been developed. GRA

N76-21616# California Univ., Berkeley. Earthquake Engineering Research Center.
FREQUENCY DEPENDENT STIFFNESS MATRICES FOR VISCOELASTIC HALF PLANE FOUNDATIONS
Anil K. Chopra, P. Chakrabarti, and Gautam Dasgupta Aug. 1975 129 p refs
(Grant NSF ATA-74-20554)
(PB-248121/6; EERC-75-22) Avail: NTIS HC $6.00 CSCL 13M

Numerical results are presented for frequency-dependent, complex-valued stiffness influence coefficients for a homogeneous, isotropic, linearly viscoelastic halfspace in plane strain or generalized plane stress. These influence coefficients, defined for uniformly spaced nodal points at the surface, are obtained from solutions of two boundary value problems, associated with unit harmonic displacements prescribed separately in each of the two degrees-of-freedom of one nodal point with all other nodal points kept fixed. Using the results of this work, the earthquake response of a structure, can be analyzed by the substructure method.
GRA

N76-21617# Army Materiel Command, Texarkana, Tex. Intern Training Center.
NONDESTRUCTIVE TESTING METHODS FOR SHELTER PANELS Final Report
J. Daniel Brannon Apr. 1974 70 p refs
(AD-A009286; USAMC-ITC-02-08-75-002) Avail: NTIS CSCL 15/5

Research is discussed that is designed to evaluate methods of nondestructively testing composite panels used in portable shelters. The panels have a core material composed of foam, balsawood, or paper honeycomb. A metal or fiber glass facing surrounds the core material. Disbonds, crushed core, water damage, and impact damage can occur in the panels. These flaws degrade the performance of the panels. The surveyed testing methods are grouped into the following categories: (1) radiography, (2) acoustics, (3) eddy sonics, (4) thermal methods, (5) the vacuum displacement technique, (6) holographic interferometry, and (7) the coefficient of restitution method. The last three were selected for closer study. The three methods were evaluated on the basis of dependability, portability, and the tasks required of the operator. The advantages and disadvantages of testing with each device are noted. Author (GRA)

N76-21618# Wisconsin Univ., Madison. Mathematics Research Center.
MINIMUM-VOLUME DESIGN OF ELASTIC TRUSSES WITH DEFLECTION CONSTRAINT
N. C. Huang Mar. 1975 34 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-A011017; MRC-TSR-1512) Avail: NTIS CSCL 20/11

The minimum-volume design of an elastic truss with deflection constraints is analyzed. Optimality conditions are obtained by means of the calculus of variations technique utilizing the principle of stationary mutual complementary energy. In comparison with the method based on searching technique in nonlinear programming, it is found that the calculus of variations approach provides us with a better understanding of the general characteristics of the problem. It is shown that for a single loading with a single deflection constraint, the optimum truss is statically determinate. The effects of inequality stress constraints and multiple loadings are examined. Examples which illustrate the methods developed are presented. Author

N76-21619# Ballistic Research Labs., Aberdeen Proving Ground, Md.
STRESSES IN A HOLLOW ELASTIC CYLINDER PRODUCED BY A STEP FUNCTION OF PRESSURE OR SHEAR
Alexander S. Elder and Kathleen P. Zimmerman Mar. 1975 32 p refs
(DA Proj. 1T1-61102-A-33H)
(AD-A008966; BRL-MR-2454) Avail: NTIS CSCL 19/6

The stresses in an infinite, hollow, elastic cylinder due to discontinuous internal loading are expressed in terms of Fourier integrals. The stresses are calculated by the theory of residues in the manner indicated by A. I. Lure in his text, Three Dimensional Problems of the Theory of Elasticity. In order to obtain the required degree of accuracy, new algorithms were derived and programmed on an electronic computer. GRA

N76-21620# Agbabian Associates, El Segundo, Calif.
REINFORCED CONCRETE ON CONSTITUTIVE RELATIONS Final Report, 6 Mar. 1973 - 8 Mar. 1974
S. Adham, A. Bhaumik, and J. Tsenberg Feb. 1975 359 p refs
(Contract F29601-73-C-0070)
(AD-A007886; AFWL-TR-74-72) Avail: NTIS CSCL 13/3

A mathematical model of reinforced concrete is derived from stress/strain relations of reinforcing steel and plain concrete, and from considering slip in bond between them. The stress/strain relations are nonlinear due to inelasticity of the concrete and steel and to cracking. They are presented in the form of a variable modulus model for use in a finite element code. The stress/strain relations for plain concrete are based on experimental data obtained under uniaxial, biaxial and triaxial states of stress. Additional laboratory experiments were performed under this contract to investigate the bond slip relation in tension and in compression. Until cracking occurs, properties of the model depend on the entire stiffness of steel and concrete. After cracking, a composite modulus is used which reflects the combined stiffness of steel and concrete and takes into account the extent to which bond between steel and concrete is broken. This model is incorporated in a dynamic inelastic finite element code and is used to analyze reinforced concrete members such as beams subjected to static and dynamic loading. Author

N76-21621# Texas Univ., Austin. Center for Highway Research.
CORROSION PROTECTION OF REINFORCING STEEL PROVIDED BY POLYMER-IMPREGNATED CONCRETE
David W. Fowler, Donald R. Paul, and Piti Yimprasert Dec. 1974 32 p refs Sponsored by DOT and Texas Highway Dept.
(PB-247378/3; CFHR-3-9-71-114-2) Avail: NTIS HC $4.00 CSCL 13C

The protection against corrosion provided reinforcing bars by polymer-impregnated concrete was investigated. Partially-impregnated slabs and fully-impregnated piling specimens were used in the investigation. The slabs were sprayed with salt water for 20 months and the pilings were immersed in sea water for 12 and 28 months. The bars from the control slabs had about 24 times more surface area corrosion than bars from the treated slabs. The chloride content in the treated slabs ranged from 4.6 percent to 38.2 percent of that in the control slabs. The bars from the control piles had corrosion ranging from 10 percent to 39 percent over the surface area while the PIC specimens had corrosion over 0.5 percent or less of the bar area. The chloride content of the PIC piles ranged from 3.4 percent to 8.5 percent of the chloride in the controls. GRA

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N76-21622* + National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LANDSAT: US STANDARD CATALOG, 1-29 FEBRUARY 1976

29 Feb. 1976 135 p

(NASA-TM-X-73047; GSFC/LU-76/002) Avail: NTIS HC $5.00 CSCL 05B

The U.S. Standard Catalog lists U.S. imagery acquired by LANDSAT 1 and LANDSAT 2 which has been processed and input to the data files during the referenced month. Data, such as date acquired, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given. Author

N76-21623* + National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LANDSAT: NON-US STANDARD CATALOG, 1-29 FEBRUARY 1976

29 Feb. 1976 110 p

(NASA-TM-X-73048; GSFC/LN-76/002; NTISUB/B/139-76/002) Avail: NTIS HC $5.00 CSCL 05B

Information regarding the availability of LANDSAT imagery processed and input to the data files by the NASA Data Processing Facility is published on a monthly basis. The U.S. Standard Catalog includes imagery covering the continental United States, Alaska and Hawaii. The non-U.S. Standard Catalog identifies all the remaining coverage. Sections 1 and 2 describe the contents and format for the catalogs and the associated microfilm. Section 3 provides a cross-reference defining the beginning and ending dates for LANDSAT cycles. Sections 4 and 5 cover LANDSAT-1 and LANDSAT-2 coverage, respectively. Author

N76-21624* + National Aeronautics and Space Administration, Washington, D.C.

EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 7

Feb. 1976 117 p refs

(NASA-SP-7041(07)) Avail: NTIS HC $4.00 CSCL 05B

This bibliography lists 492 reports, articles, and other documents introduced into the NASA scientific and technical information system between July 1975 and September 1975. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. Author

N76-21625*# Centre National d'Etudes Spatiales, Toulouse (France).

THE POSSIBILITY OF EVALUATING VERTICAL WIND PROFILES FROM SATELLITE DATA Final Report

A. Villevielle, Principal Investigator and A. B. Weiller [1975] 42 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP

(E76-10210; NASA-CR-147475) Avail: NTIS HC $4.00 CSCL 04B

There are no author-identified significant results in this report.

N76-21626*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

COMPUTER IMPLEMENTED LAND USE CLASSIFICATION WITH ERTS DIGITAL DATA DURING THREE SEASONS

Armond T. Joyce, Principal Investigator Jun. 1974 23 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP

(E76-10228; NASA-TM-X-72993; Rept-135) Avail: NTIS HC $3.50 CSCL 05B

There are no author-identified significant results in this report.

N76-21627*# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).

WATER UTILISATION, EVAPOTRANSPIRATION AND SOIL MOISTURE MONITORING IN THE SOUTHEAST REGION OF SOUTH AUSTRALIA Quarterly Progress Report

K. John Shepherd, Principal Investigator, Keith R. McCloy, James C. Killick, and Max R. Till [1975] 4 p Sponsored by NASA ERTS

(E76-10234; NASA-CR-146517) Avail: NTIS HC $3.50 CSCL 08M

There are no author-identified significant results in this report.

N76-21628*# Texas Univ., Austin. Dept. of Astronomy.

ULTRAVIOLET STELLAR ASTRONOMY

Karl G. Henize, James D. Wray, Yoji Kondo (NASA. Johnson Space Center), and Fred OCallaghan, Principal Investigators (Perkin-Elmer Corp.) Dec. 1975 103 p refs EREP

(Contract NAS9-13176)

(E76-10235; NASA-CR-147488) Avail: NTIS HC $5.50 CSCL 03A

The author has identified the following significant results. During all three Skylab missions, prism-on observations were obtained in 188 starfields and prism-off observations in 31 starfields. In general, the fields are concentrated in the Milky Way where the frequency of hot stars is highest. These fields cover an area approximately 3660 degrees and include roughly 24 percent of a band 30 deg wide centered on the plane of the Milky Way. A census of stars in the prism-on fields shows that nearly 6,000 stars have measurable flux data at a wavelength of 2600A, that 1,600 have measurable data at 2000A, and that 400 show useful data at 1500A. Obvious absorption or emission features shortward of 2000A are visible in approximately 120 stars. This represents a bonanza of data useful for statistical studies of stellar classification and of interstellar reddening as well as for studies of various types of peculiar stars.

N76-21629*# Minnesota State Planning Agency, St. Paul.

ANALYSIS OF DATA FOR LANDSAT (ERTS) FOLLOW-ON Progress Report, 26 Jun. - 25 Sep. 1975

Joseph E. Sizer, Principal Investigator 19 Nov. 1975 10 p ERTS

(Contract NAS5-20985)

(E76-10245; NASA-CR-146527) Avail: NTIS HC $3.50 CSCL 05B

There are no author-identified significant results in this report.

N76-21630*# Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.

APPLICATION OF LANDSAT DATA TO DELIMITATION OF AVALANCHE HAZARDS IN MONTANE, COLORADO Interim Report, Dec. 1975 - Feb. 1976

Daniel H. Knepper, Principal Investigator and R. Summer Mar. 1976 16 p refs ERTS

(Contract NAS5-20914)

(E76-10257; NASA-CR-146629; QPR-3) Avail: NTIS HC $3.50 CSCL 08L

The author has identified the following significant results. With rare exceptions, avalanche areas cannot be identified on LANDSAT imagery. Avalanche hazard mapping on a regional scale is best conducted using LANDSAT imagery in conjunction with complementary data sources. Level of detail of such maps will be limited by the amount and completeness of the complementary information used.

N76-21631*# National Space Development Agency, Tokyo (Japan).

STUDY OF MESOSCALE PHENOMENA, WINTER MONSOON CLOUDS AND SNOW AREA BASED ON LANDSAT DATA

Kiyoshi Tsuchiya, Principal Investigator Jan. 1976 33 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E76-10261; NASA-CR-146633) Avail: NTIS HC $4.00 CSCL 08L

The author has identified the following significant results. Most longitudinal clouds which appear as continuous linear clouds are composed of small transversal clouds. There are mountain waves of different wavelength in a comparatively narrow area indicating complicated orographical effects on wind and temperature distribution or on both dynamical and static stability condition. There is a particular shape of cirrus cloud suggestive of turbulence in the vicinity of CAT in the upper troposphere near jet stream level and its cold air side. Thin cirrus of overcast condition can be distinguished by MSS; however, extremely thin cirrus of partly cloudy condition cannot be detected even in LANDSAT data. This presents a serious problem in the interpretation of satellite thermal infrared radiation data since they affect the value.

N76-21632*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

EXTENSIVE INVENTORY OF FOREST RESOURCES BY MULTISTAGE SAMPLING Progress Report, 7 Dec. 1975 - 7 Mar. 1976

Robert C. Aldrich, Robert W. Dana, and Edwin H. Roberts, Principal Investigators 19 Mar. 1976 6 p ERTS

(NASA Order S-54053-A)

(E76-10265; NASA-CR-146566; PR-4) Avail: NTIS HC $3.50 CSCL 02F

There are no author-identified significant results in this report.

N76-21633*# Virginia Univ., Charlottesville. Dept. of Environmental Sciences.

SHORELINE CONFIGURATION AND SHORELINE DYNAMICS: A MESOSCALE ANALYSIS

R. Dolan, Principal Investigator, B. P. Hayden, and J. E. Heywood [1975] 22 p refs ERTS

(Contract NAS5-20999)

(E76-10266; NASA-CR-146567) Avail: NTIS HC $3.50 CSCL 08J

The author has identified the following significant results. Atlantic coast barrier island shorelines are seldom straight, but rather sinuous. These shoreline curvatures range in size from cusps to capes. Significant relationships exist between the orientation of shoreline segments within the larger of these sinuous features and shoreline dynamics, with coefficients ranging up to .9. Orientation of the shoreline segments of Assateague Island (60 km) and the Outer Banks of North Carolina (130 km) was measured from LANDSAT 2 imagery (1:80,000) and high altitude aerial photography (1:120,000). Long term trends in shoreline dynamics were established by mapping shoreline and storm-surge penetration changes.

N76-21634*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

CROP IDENTIFICATION FROM RADAR IMAGERY OF THE HUNTINGTON COUNTY, INDIANA TEST SITE

P. P. Batlivala and F. T. Ulaby, Principal Investigators Nov. 1975 25 p refs EREP

(Contract NAS9-10261)

(E76-10267; NASA-CR-147516; RSL-TR-177-58) Avail: NTIS HC $3.50 CSCL 02B

The author has identified the following significant results. Like polarization was successful in discriminating corn and soybeans; however, pasture and woods were consistently confused as soybeans and corn, respectively. The probability of correct classification was about 65%. The cross polarization component (highest for woods and lowest for pasture) helped in separating the woods from corn, and pasture from soybeans, and when used with the like polarization component, the probability of correct classification increased to 74%.

N76-21635*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

RESULTS FROM THE CROP IDENTIFICATION TECHNOLOGY ASSESSMENT FOR REMOTE SENSING (CITARS) PROJECT

M. E. Bauer, Principal Investigator, B. J. Davis, R. M. Bizzell (NASA. Johnson Space Center), F. G. Hall (NASA. Johnson Space Center), A. H. Feiveson (NASA. Johnson Space Center), W. A. Malila (Environmental Res. Inst. of Michigan, Ann Arbor) (Environmental Res. Inst. of Michigan, Ann Arbor), and D. P. Rice 1976 40 p refs Presented at Proc. of the 10th Intern. Symp. on Remote Sensing of Environment, Ann Arbor, Mich., 6-10 Oct. 1975 Original contains imagery. Original Photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP

(Contract NAS9-14016)

(E76-10268; NASA-CR-147518; LARS-Inform-Note-012176) Avail: NTIS HC $4.00 CSCL 02B

The author has identified the following significant results. It was found that several factors had a significant effect on crop identification performance: (1) crop maturity and site characteristics, (2) which of several different single date automatic data processing procedures was used for local recognition, (3) nonlocal recognition, both with and without preprocessing for the extension of recognition signatures, and (4) use of multidate data. It also was found that classification accuracy for field center pixels was not a reliable indicator of proportion estimation performance for whole areas, that bias was present in proportion estimates, and that training data and procedures strongly influenced crop identification performance.

N76-21636*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.

APPLICATION OF LANDSAT TO THE SURVEILLANCE AND CONTROL OF LAKE EUTROPHICATION IN THE GREAT LAKES BASIN Progress Report, Jan. - Apr. 1976

Robert H. Rogers, Principal Investigator Apr. 1976 21 p ERTS

(Contract NAS5-20942)

(E76-10269; NASA-CR-146568; BSR-4224) Avail: NTIS HC $3.50 CSCL 08H

The author has identified the following significant results. Computer techniques were developed for mapping water quality parameters from LANDSAT data, using surface samples collected in an ongoing survey of water quality in Saginaw Bay. Chemical and biological parameters were measured on 31 July 1975 at 16 bay stations in concert with the LANDSAT overflight. Application of stepwise linear regression bands to nine of these parameters and corresponding LANDSAT measurements for bands 4 and 5 only resulted in regression correlation coefficients that varied from 0.94 for temperature to 0.73 for Secchi depth. Regression equations expressed with the pair of bands 4 and 5, rather than the ratio band 4/band 5, provided higher correlation coefficients for all the water quality parameters studied (temperature, Secchi depth, chloride, conductivity, total kjeldahl nitrogen,

total phosphorus, chlorophyll a, total solids, and suspended solids).

N76-21637*# Northern Prairie Wildlife Research Center, Jamestown, N. Dak.
APPLICATION OF LANDSAT SYSTEM FOR IMPROVING METHODOLOGY FOR INVENTORY AND CLASSIFICATION OF WETLANDS Progress Report, 1 Jan. - 31 Mar. 1976
David S. Gilmer, Principal Investigator and Edgar A. Work, Jr. 5 Apr. 1976 8 p ERTS
(NASA Order S-54049-A)
(E76-10270; NASA-CR-146569) Avail: NTIS HC $3.50 CSCL 08B

There are no author-identified significant results in this report.

N76-21638*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
CORN GROWTH AS MONITORED BY RADAR
Fawwaz T. Ulaby and Thomas F. Bush, Principal Investigators Nov. 1975 134 p refs EREP
(Contract NAS9-10261)
(E76-10271; NASA-CR-147515; RSL-TR-177-57) Avail: NTIS HC $6.00 CSCL 02C

The author has identified the following significant results. At angles of incidence of 40 deg or greater, the results of the data analysis indicate a strong correlation between the radar backscattering coefficient and the normalized plant water content w(pn), where w(pn) is the mass of water in the corn plant divided by its height. The correlation coefficient between the backscattering coefficient and w(pn), which was calculated for each of 176 different combinations of the radar parameters (signal frequency, angle of incidence, and polarization) was highest (0.96) at 17.0 GHz, 50 deg and VV polarization. Considering the fact that the data used covered a period of four months during which the corn plants underwent considerable change in geometry and dielectric properties, the high correlation of 0.96 between backscattering coefficient and w(pn) points to a promising future for radar as a tool for monitoring corn development.

N76-21639*# Colorado State Univ., Fort Collins. Dept. of Earth Resources.
SIGNATURE EXTENSION FOR SUN ANGLE, VOLUME 1 Final Report, 15 Nov. 1974 - 14 Nov. 1975
J. A. Smith, Principal Investigator, J. K. Berry, and F. Heimes Nov. 1975 111 p refs EREP
(Contract NAS9-14467)
(E76-10272; NASA-CR-147464) Avail: NTIS HC $5.00 CSCL 03B

The author has identified the following significant results. Within a restricted zenith sun angle range of 35 - 50 degrees, it was empirically observed that canopy reflectance is mainly Lambertian. Reflectance changes with crop stage were simple shifts in scale in the sun angle range. It was noted that sun angle variations depend on canopy characteristics. Effects of the vegetative canopy were most pronounced at the larger solar zenith angles (20 %). The linear sun angle correction coefficients demonstrate a dependency on both crop stage (15-20 %) and crop type (10-20 %). The use of canopy reflectance modeling allowed for the generation of a simulated data set over an extremely broad envelope of sun angles.

N76-21640*# Colorado State Univ., Fort Collins. Dept. of Earth Resources.
SIGNATURE EXTENSION FOR SUN ANGLE, VOLUME 2 Final Report, 15 Nov. 1974 - 14 Nov. 1975
J. A. Smith, Principal Investigator, J. K. Berry, and F. Heimes Nov. 1975 130 p refs EREP
(Contract NAS9-14467)
(E76-10273; NASA-CR-147465) Avail: NTIS HC $6.00 CSCL 03B

There are no author-identified significant results in this report.

N76-21641*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
PLANNING APPLICATIONS IN EAST CENTRAL FLORIDA Progress Report, 12 Nov. 1975 - 11 Feb. 1976
John W. Hannah (Brevard County Planning Dept., Fla.), Garland L. Thomas, and Fernando Esparza, Principal Investigators 11 Feb. 1976 29 p ref ERTS
(Contract NAS5-20907)
(E76-10274; NASA-TM-X-73043; BCPD-L2-4) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N76-21642*# Coffee Institute, Rio de Janeiro (Brazil).
COFFEE INVENTORY THROUGH ORBITAL IMAGERY
Marcos Henrique Velloso, Principal Investigator, Antonieta Pardal CoutinhodeMoraes, Dyckson DiasdeSouza, Hector McNeill, Jose Maria Assumpcao, and Shoji Iwamoto Dec. 1974 19 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10275; NASA-CR-146646; Rept-1) Avail: NTIS HC $3.50 CSCL 02C

There are no author-identified significant results in this report.

N76-21643*# Department of Industry, London (England).
THE USE OF ERTS/LANDSAT IMAGERY IN RELATION TO AIRBORNE REMOTE SENSING FOR TERRAIN ANALYSIS IN WESTERN QUEENSLAND, AUSTRALIA Quarterly Report
Monica M. Cole, Principal Investigator and Stewart Owen-Jones 26 Mar. 1976 23 p Sponsored by NASA and United Kingdom Dept. of Industry Original contains imagery. Orginal photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10276; NASA-CR-146542) Avail: NTIS HC $3.50 CSCL 08B

The author has identified the following significant results. LANDSAT 1 and 2 imagery contrast the geology of the Cloncurry-Dobbyn and the Gregory River-Mt. Isa areas very clearly. Known major structural features and lithological units are clearly displayed while, hitherto unknown lineaments were revealed. Throughout this area, similar rock types produce similar spectral signatures, e.g. quartzites produce light signatures, iron rich rocks produce dark signatures. More geological data are discernible at the 1:50,000 scale than on the 1:250,000 scale. Ore horizons may be identified at the 1:50,000 scale, particularly where they are associated with iron rich rocks. On the level plains north of Cloncurry, distinctive spectral signatures produced by the combined reflectances of plant cover, soils, and geology, distinguish different types of superficial deposits. Existing and former channels of the Cloncurry and Williams Rivers are distinguished at the 1:50,000 scale on both the LANDSAT 1 and 2 imagery. On the Cloncurry Plains, fence lines are discernible on the 1:50,000 LANDSAT 2 imagery.

N76-21644*# Department of Industry, London (England).
THE IDENTIFICATION OF CLOUD TYPES IN LANDSAT MSS IMAGES Quarterly Report
Eric C. Barrett, Principal Investigator and Colin K. Grant Mar. 1976 46 p refs Sponsored by NASA and United Kingdom Dept. of Industry Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10277; NASA-CR-146647; QR-2) Avail: NTIS HC $4.00 CSCL 04B

The author has identified the following significant results. Five general families of clouds were identified: cumulonimbiform, cumuliform, stratiform, stratocumuliform, and cirriform. Four members of this five-fold primary division of clouds were further divided into a number of subgroups. The MSS observed and recorded earth radiation in four different wavebands. Two of these bands (4 and 5) image in the visible portion of the electromagnetic spectrum, while the others (6 and 7) image the short wave portion, or just into the infrared. The main differences between the appearances of clouds in the four wavebands are related to the background brightness of land and sea surfaces.

N76-21645*# National Univ. of Lesotho, Roma. Dept. of Biology.
NATURAL RESOURCES RESEARCH AND DEVELOPMENT

IN LESOTHO USING LANDSAT IMAGERY Quarterly Report, Dec. 1975 - Feb. 1976
A. A. Jackson, Principal Investigator 3 Mar. 1976 8 p Sponsored by NASA and Environmental Res. Inst. of Michigan ERTS
(E76-10278; NASA-CR-146648; LLII/1) Avail: NTIS HC $3.50 CSCL 08F

The author has identified the following significant results. A map of the drainage of the whole country to include at least third order streams was constructed from LANDSAT imagery. This was digitized and can be plotted at any required scale to provide base maps for other cartographic projects. A suite of programs for the interpretation of digital LANDSAT data is under development for a low cost programmable calculator. Initial output from these programs has proved to have better resolution and detail than the standard photographic products, and was to update the standard topographic map of a particular region.

N76-21646*# Instituto Geografico y Catastral, Madrid (Spain).
THEMATIC MAPPING, LAND USE, GEOLOGICAL STRUCTURE AND WATER RESOURCES IN CENTRAL SPAIN Quarterly Report
Nunez DelasCuevas, Principal Investigator 15 Feb. 1976 17 p Sponsored by NASA Original contains color illustrations ERTS
(E76-10279; NASA-CR-146649; QR-1) Avail: NTIS HC $3.50 CSCL 08B

There are no author-identified significant results in this report.

N76-21647*# Division of National Mapping, Canberra (Australia).
MAPPING ISLANDS, REEFS AND SHOALS IN THE OCEANS SURROUNDING AUSTRALIA Quarterly Report, 8 Nov. 1975 - 8 Feb. 1976
Leonard G. Turner, Principal Investigator 8 Feb. 1976 4 p Sponsored by NASA ERTS
(E76-10280; NASA-CR-146650; QR-2) Avail: NTIS HC $3.50 CSCL 08B

The author has identified the following significant results. Two geometric distortion tests of the same scene using different ground control identification methods have produced different estimates of the magnitude of geometric distortions of the image frame. A comparison of imagery with hydrographic charts shows that the imagery displays shoals and reefs which are close to the water surface. Such information can be used during the compilation of new maps of such regions, in the checking of existing hydrographic charts, or for navigation warning.

N76-21648*# Ecole Practique des Hautes Etudes, Paris (France).
THE FRENCH ATLANTIC LITTORAL AND THE MASSIF ARMORICAIN Progress Report, Jan. - Mar. 1976
Fernand Verger, Principal Investigator, Jean-Marie Monget, and Jean-Yves Scanvic Mar. 1976 28 p refs Sponsored by NASA and CNS Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10281; NASA-CR-146651; Rept-2) Avail: NTIS HC $4.00 CSCL 08E

The author has identified the following significant results. Diachronic use of LANDSAT data time series will in time allow study of statistically submerged frequencies in tidal areas. This is an essential element of coastal geomorphology and of coastal zone management, being particularly useful in siting shellfish farms. Maps at useable scales and simple user oriented legends should become an essential document for coastal planning agencies.

N76-21649*# Maden Tetkik ve Arma Enstitusu, Ankara (Turkey).
NATIONAL PROJECT FOR THE EVALUATION OF ERTS IMAGERY APPLICATIONS TO VARIOUS EARTH RESOURCES PROBLEMS OF TURKEY Progress Report, 1 Oct. - 31 Dec. 1975
Sadrettin Alpan, Principal Investigator 31 Dec. 1975 12 p Sponsored by NASA ERTS
(E76-10282; NASA-CR-146652; PR-1) Avail: NTIS HC $3.50 CSCL 08F

There are no author-identified significant results in this report.

N76-21650*# Geological Survey, Reston, Va.
DETECTION AND MAPPING OF MINERALIZED AREAS IN THE CORTEZ-UINTA BELT, UTAH-NEVADA, USING COMPUTER-ENHANCED ERTS IMAGERY Progress Report
Lawrence C. Rowan, Principal Investigator 15 Feb. 1976 40 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10283; NASA-CR-146653) Avail: NTIS HC $4.00 CSCL 08G

The author has identified the following significant results. Mineralogical differences between hydrothermally altered rocks and most unaltered rocks in south central Nevada cause visible and near infrared (0.45-2.4 micron) spectral reflectance differences which can be used to discriminate broad categories of rocks in multispectral images. The most important mineralogical differences are the increased abundance of goethite, hematite, jarosite, alunite, montmorillonite, and kaolinite in the altered zones. Because of the wavelength positions and widths of the LANDSAT MSS bands, these spectral differences are not apparent in individual or color infrared composite MSS images. The technique developed to enhance these subtle spectral differences combines ratioing of the MSS bands and contrast stretching. Field evaluation of color-ratio composite shows that, after exclusion of alluvial areas, approximately 80% of the green and brown color patterns are related to hydrothermal alteration. The remaining 20% consists mainly of pink hematitic crystallized tuff and tan or red ferruginous shale and siltstone.

N76-21651*# Geological Survey, Reston, Va.
[THE USE OF THE LANDSAT DATA COLLECTION SYSTEMS (DCS) FOR RELAYING HYDROLOGIC DATA] Progress Report
R. W. Paulson, Principal Investigator 31 Mar. 1976 7 p Sponsored by NASA ERTS
(E76-10284; NASA-CR-146654) Avail: NTIS HC $3.50 CSCL 08H

There are no author-identified significant results in this report.

N76-21652*# Alaska Univ., Anchorage.
LANDSAT SURVEY OF NEAR-SHORE ICE CONDITIONS ALONG THE ARCTIC COAST OF ALASKA Progress Report
William J. Stringer, Principal Investigator [1975] 54 p Sponsored by NASA ERTS
(E76-10285; NASA-CR-146655; QPR-4) Avail: NTIS HC $4.50 CSCL 08L

There are no author-identified significant results in this report.

N76-21653*# Environmental Research Inst. of Michigan, Ann Arbor.
UTILIZATION OF SKYLAB (EREP) SYSTEM FOR APPRAISING CHANGES IN CONTINENTAL MIGRATORY BIRD HABITAT Final Report, May 1973 - Dec. 1975
David S. Gilmer, Principal Investigator (Northern Prairie Wildlife Research Center, Jamestown, N. D.) and Edgar A. Work, Jr. Dec. 1975 119 p refs Original contains imagery. Original photogaraphy may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order T-4114-B; Contract DI-14-16-0008-802)
(E76-10286; NASA-CR-147542; ERIM-105500-57-F) Avail: NTIS HC $5.50 CSCL 06C

There are no author-identified significant results in this report.

N76-21654*# Iowa Univ., Iowa City. Dept. of Geology.
EXPERIMENT TO EVALUATE THE FEASIBILITY OF UTILIZING SKYLAB-EREP REMOTE SENSING DATA FOR TECTONIC ANALYSIS THROUGH A STUDY OF THE BIG HORN MOUNTAIN REGION, WYOMING, SOUTH DAKOTA AND WYMONING Final Report, Apr. 1973 - Sep. 1975
Richard A. Hoppin, Principal Investigator, James Caldwell, Donald Lehman, Steven Palmer, Kuo-Liang Pan, and Alan Swenson Mar. 1976 57 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP

(Contract NAS9-13313)
(E76-10287; NASA-CR-147543) Avail: NTIS HC $4.50 CSCL 08G

The author has identified the following significant results. S190B imagery was the best single product from which fairly detailed structural and some lithologic mapping could be accomplished in the Big Horn basin, the Owl Creek Mountains, and the northern Big Horn Mountains. The Nye-Bowler lineament could not be extended east of its presently mapped location although a linear (fault or monocline) was noted that may be part of the lineament, but north of postulated extensions. Much more structure was discernible in the Big Horn basin than could be seen on LANDSAT-1 imagery; RB-57 color IR photography, in turn, revealed additional folds and faults. A number of linears, several of which could be identified as faults and one a monocline, cut obliquely the east-west trending Owl Creek uplift. The heavy forest cover of the Black Hills makes direct lithologic delineation impossible. However, drainage and linear overlays revealed differences in pattern between the areas of exposed Precambrian crystalline core and the flanking Paleozoic rocks. S192 data, even precision corrected segments, were not of much use.

N76-21655*# California State Dept. of Water Resources, Sacramento.
[WATER QUALITY CONDITIONS IN THE SUISUN BAY PORTION OF THE SAN FRANCISCO BAY DELTA SYSTEM] Progress Report
Randall L. Brown, Principal Investigator 14 Apr. 1976 2 p ERTS
(Contract NAS5-20945)
(E76-10288; NASA-CR-146656; PR-3) Avail: NTIS HC $3.50 CSCL 08B

There are no author-identified significant results in this report.

N76-21656*# Arizona Univ., Tucson. Office of Arid Lands Studies.
APPLIED REMOTE SENSING PROGRAM (ARSP) Quarterly Progress Report, 14 Aug. 1975 - 13 Feb. 1976
Kenneth Foster, Principal Investigator 13 Feb. 1976 11 p Sponsored by NASA ERTS
(E76-10289; NASA-CR-146781; QR-3; QR-4) Avail: NTIS HC $3.50 CSCL 08B

There are no author-identified significant results in this report.

N76-21657*# Arizona Univ., Tucson. Office of Arid Lands Studies.
APPLIED REMOTE SENSING PROGRAM (ARSP) Quarterly Progress Report, 14 May - 13 Aug. 1975
Kenneth Foster, Principlal Investigator 13 Aug. 1975 4 p Sponsored by NASA ERTS
(E76-10290; NASA-CR-146782; QR-2) Avail: NTIS HC $3.50 CSCL 08B

There are no author-identified significant results in this report.

N76-21658*# Pennsylvania Univ., Philadelphia.
DETECTION OF CROP MARK CONTRAST FOR ARCHAEOLOGICAL SURVEYS Final Report, Jan. - Sep. 1975
Froelich G. Rainey, Principal Investigator, John N. Hampton (Roy. Commission on Historical Monuments, London), and Bruce W. Bevan Apr. 1976 24 p refs Sponsored in part by NSF Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20792)
(E76-10291; NASA-CR-146783) Avail: NTIS HC $3.50 CSCL 02C

There are no author-identified significant results in this report.

N76-21659*# Purdue Univ., Lafayette, Ind. Lab. of Applications of Remote Sensing.
COMPUTER-AIDED ANALYSIS OF LANDSAT-1 MSS DATA: A COMPARISON OF THREE APPROACHES, INCLUDING A MODIFIED CLUSTERING APPROACH
R. M. Hoffer, Principal Investigator, M. D. Fleming, and J. S. Berkebile 1975 9 p refs EREP
(Contracts NAS9-14016; NAS5-21880; NAS9-13380)
(E76-10292; NASA-CR-147536; LARS-Inform-Note-072475) Avail: NTIS HC $3.50 CSCL 05B

There are no author-identified significant results in this report.

N76-21660*# California Univ., Berkeley. Space Sciences Lab.
APPLICATION OF PHOTOINTERPRETATIVE TECHNIQUES TO WHEAT IDENTIFICATION, SIGNATURE EXTENSION, AND SAMPLING STRATEGY Quarterly Progress Report, 16 Nov. 1975 - 15 Feb. 1976
R. N. Colwell, Principal Investigator, C. M. Hay, and R. W. Thomas 19 Mar. 1976 8 p EREP
(Contract NAS9-14565)
(E76-10293; NASA-CR-147526; SSL-Ser-17-Issue-21) Avail: NTIS HC $3.50 CSCL 02C

There are no author-identified significant results in this report.

N76-21661*# Purdue Univ., Lafayette, Ind.
CROP IDENTIFICATION AND ACREAGE ESTIMATION OVER LARGE GEOGRAPHIC AREAS USING LANDSAT MSS DATA Quarterly Progress Report, 1 Jan. - 31 Mar. 1976
Marvin E. Bauer, Principal Investigator 31 Mar. 1976 4 p ERTS
(Contract NAS5-20793)
(E76-10294; NASA-CR-146784) Avail: NTIS HC $3.50 CSCL 02C

The author has identified the following significant results. The comparison between the acreage estimates for the April LANDSAT data and the USDA Statistical Reporting Service estimates show no significant difference for the south central crop reporting district in Kansas. A paired-t test with an alpha = .05 was run comparing the percentages of wheat in each county. The results of their test showed no significant difference between the two estimates for wheat.

N76-21662*# Colorado School of Mines, Golden. Dept. of Geology.
REMOTE SENSING IN MINERAL EXPLORATION FROM LANDSAT (ERTS) IMAGERY. TEST SITE NO. 2 (COLORADO) Progress Report, 31 Dec. 1975 - 31 Mar. 1976
R. H. Carpenter, Principal Investigator and D. W. Trexler Apr. 1976 7 p ref ERTS
(Contract NAS5-20955)
(E76-10295; NASA-CR-146785) Avail: NTIS HC $3.50 CSCL 08G

There are no author-identified significant results in this report.

N76-21663*# South Dakota State Univ., Brookings. Remote Sensing Inst.
INVESTIGATION OF REMOTE SENSING TECHNIQUES AS INPUTS TO OPERATIONAL RESOURCE MANAGEMENT MODELS Interim Report, 11 Dec. 1975 - 10 Mar. 1976
F. A. Schmer, Principal Investigator and R. E. Isakson Mar. 1976 48 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20982)
(E76-10296; NASA-CR-146786; SDSU-RSI-76-01) Avail: NTIS HC $4.00 CSCL 05A

There are no author-identified significant results in this report.

N76-21664*# Centre National d'Etudes Spatiales, Paris (France).
THE FRENCH ATLANTIC LITTORAL AND THE MASSIF ARMORICAIN Progress Report, Jan. - Mar. 1976
Fernand Verger, Principal Investigator, Jean-Marie Monget, and Jean-Yves Scanvic Mar. 1976 28 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10298; NASA-CR-146788; PR-2) Avail: NTIS HC $4.00 CSCL 08J

The author has identified the following significant results. Diachronic use of LANDSAT data time series will in time allow statistical study of submersion frequencies in tidal areas. This is an essential element of coastal geomorphology and of coastal zone management being particularly useful in siting shellfish farms. Maps are being obtained at useable scales and simple, user oriented legends which can be used for coastal planning.

N76-21665*#. Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

COMPUTER CLASSIFICATION OF REMOTELY SENSED MULTISPECTRAL IMAGE DATA BY EXTRACTION AND CLASSIFICATION OF HOMOGENEOUS OBJECTS

R. L. Kettig 1975 194 p refs

(Contract NAS9-14016)

(NASA-CR-147403; LARS-IN-050975) Avail: NTIS HC $7.50 CSCL 05B

A method of classification of digitized multispectral images is developed and experimentally evaluated on actual earth resources data collected by aircraft and satellite. The method is designed to exploit the characteristic dependence between adjacent states of nature that is neglected by the more conventional simple-symmetric decision rule. Thus contextual information is incorporated into the classification scheme. The principle reason for doing this is to improve the accuracy of the classification. For general types of dependence this would generally require more computation per resolution element than the simple-symmetric classifier. But when the dependence occurs in the form of redundance, the elements can be classified collectively, in groups, therby reducing the number of classifications required. Author

N76-21666# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Flugzeuge.

COMPARATIVE INVESTIGATION ON RECOGNITION RANGES OF IR AND TV SENSORS SUBJECTED TO VARIOUS ENVIRONMENTAL AND WEATHER CONDITIONS

Helmut Ostermeier 15 May 1974 106 p refs In GERMAN; ENGLISH summary

(MBB-UFE-1093-O) Avail: NTIS HC $5.50

Investigations are reported on remote sensing of the earth from an aircraft. Sensors considered are low light level TV cameras and infrared scanners for the wavelength range 8 to 14 micron. Calculations show that remote sensing with TV is possible only under favourable lighting conditions (daylight, clear full moon). IR scanner sensing is possible at night and under nearly all environmental and weather conditions. IR scanners are superior to the TV cameras for mist and fog conditions. Loss of contrast due to rain is a disadvantage for the scanner. Wide range IR scanning is possible for artificially treated targets, e.g. running combustion engines. ESA

N76-21667# Federal Energy Administration, Washington, D.C.

OIL AND GAS RESOURCES, RESERVES, AND PRODUCTIVE CAPACITIES, VOLUME 2 Final Report

Oct. 1975 160 p

(PB-246355/2; FEA/G-75/619-Vol-2) Avail: NTIS HC $6.75 CSCL 08I

The Federal Energy Administration Act directs the FEA to prepare a complete and independent analysis of actual oil and gas reserves and resources in the United States and its outer continental shelf. Volume I of this final report provides final reserve and productive capacity estimates, compares these estimates with estimates from other sources, projects a U.S. crude oil productive capacity estimate, evaluates the procedures used to develop these estimates, and recommends procedures to be used for future estimates. Volume 2 provides summaries of engineering analyses of major domestic oil and gas fields. GRA

N76-21668# Texas Univ., Austin. Center for Cybernetic Studies.

SIMULTANEOUS INVESTMENT-ALLOCATION AND APPLICATION OF GENERALIZED BENDERS DECOMPOSITION TO WATER PLANNING

Ronald D. Armstrong and Cleve E. Willis (Mass. Univ., Amherst) Aug. 1975 25 p refs

(Contracts N00014-75-C-0616; N00014-75-C-0569; NR Proj. 047-021)

(AD-A017937; CCS-243) Avail: NTIS CSCL 13/2

This paper develops models for water planning that will simultaneously consider investment and allocation decisions. The framework is demonstrated for a region which includes the counties of San Luis Obispo and Santa Barbara in California. The quadratic discontinuous mathematical programming problems resulting from such models are solved optimally by using generalized Benders decomposition. GRA

N76-21669# Minnesota Univ., St. Paul. Water Resources Research Center.

A HYDRONOMIC ANALYSIS OF FOREST MANAGEMENT ALTERNATIVES FOR ENVIRONMENTAL QUALITY: A CASE STUDY OF ITASCA COUNTY

Arthur P. OHayre, John C. Clausen, and Arnett C. Mace, Jr. Aug. 1975 134 p refs

(PB-248046/5; WRC-Bull-83; W76-02362; OWRT-B-053-MINN-1) Avail: NTIS HC $6.00 CSCL 02F

The input-output technique was the general methodology used for integrating water use. Direct and direct-plus-indirect water use coefficients (total withdrawn and consumptive) were determined for each of the 34 economic sectors in Itasca County, Minnesota. An example was developed that compared the water yield from the harvesting alternatives of clearcutting, strip cuts, and selection cuts. A zero water use coefficient was used for timber production, under water surplus conditions, and the water required was 44 million gallons. GRA

N76-21670# Illinois Univ., Champaign. Center for Advanced Computation.

RESERVE AND RESOURCE ESTIMATION, APPENDIX D Final Report

Michael Rieber, Shao Lee Soo, and James Stukel May 1975 72 p refs

(Grant NSF GI-35821)

(PB-248063/0; CAC-163-App-D; NSF/RA/N-75-037D) Avail: NTIS HC $4.50 CSCL 08G

Briefly discussed are Illinois and Wyoming coal reserves, availability of public land for coal mining. National Environmental Policy Act, Clean Air Act, and Federal Water Pollution Control Act. GRA

N76-21671# Massachusetts Univ., Amherst. Water Resources Research Center.

MODELING THE DYNAMIC RESPONSE OF FLOOD PLAINS TO URBANIZATION IN SOUTHEASTERN NEW ENGLAND

Donald O. Doehring, Julius Gy Fabos, and Mark E. Smith Jun. 1975 35 p refs

(Contract DI-14-31-0001-5021)

(PB-248407/9; Completion-FY-75-6; Pub-53; W76-02865; OWRT-A-074-MASS(1)) Avail: NTIS HC $4.00 CSCL 08H

The relations between land use changes and flood expectancies in southeastern New England is examined. The common assumption that urbanization affects only floodplains related to low return period events is also evaluated with respect to this region. Watershed morphometry, surficial character, and land use were considered to be the most important independent variables which could be quantified. The dependent variable, an index of change in flood expectancy, is conceptualized as a response to land use change; morphometry and surficial character of a given basin are conceived as factors which condition the primary response. Mathematical models which were erected by multiple regression techniques are useful for predicting change in flood expectancies and account for more than 97% of the total variance. GRA

N76-21672# Kansas State Highway Commission, Topeka. Remote Sensing Section.

SOIL IDENTIFICATION BY REMOTE SENSING TECHNIQUES IN KANSAS, PART 2 Final Report

L. D. Myers and A. H. Stallard Jul. 1975 32 p

(PB-248219/8; FHWA-RD-75-129-Pt-2) Avail: NTIS HC $4.00 CSCL 08B

The purpose is to evaluate various types of remote sensing data when used to delineate and map engineering soil conditions that are significant in highway engineering. Three study areas

provided a broad spectrum of soils and geologic conditions encountered in eastern Kansas. Delineation of these soil types and conditions is feasible with color aerial photography and appropriate ground reconnaissance. In addition, general information pertaining to depth to bedrock and the ground water table can be extracted from aerial photography; however, more detailed information of this type, that might be obtained on infrared imagery, would be invaluable. GRA

N76-21673# National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Environmental Research Lab.
EVAPORATION FROM LAKE ERIE
Jan A. Derecki Jun. 1975 92 p
(PB-248300/6; GLERL-3; GLERL-Contrib-28; NOAA-75121004; NOAA-TR-ERL-342) Avail: NTIS HC $5.00 CSCL 08H

The monthly evaporation from Lake Erie was derived by the water budget, two mass transfer, energy budget, and two combined mass transfer-energy budget equations. Evaporation determined by a single method is not sufficiently reliable and requires verification of accuracy by different methods. Only the water budget method determines evaporation directly, as a residual from other measurements, and it was used as a control for other estimates of evaporation. The overall analysis of results indicates that reasonably accurate evaporation estimates during the year can be obtained by the water budget and the modified Lake Hefner mass transfer equations, and during the high evaporation season by the energy budget equation. GRA

N76-21674# Air Samplex Corp., Indian Hills, Colo.
GEOLOGY, ORE DEPOSITS, AND MINERAL POTENTIAL OF THE SEWARD PENINSULA ALASKA Open File Report, 1965 - 1975
C. L. Sainsbury Sep. 1975 134 p refs
(PB-247099/5; BM-OFR-73-75) Avail: NTIS HC $6.00 CSCL 08G

Efforts made to put under one title all of the geologic maps of the Seward Peninsula, Alaska, published in open files since 1965 are reported. Attempts were also made to synthesize the economic geology and mineral potential of that important region as an aid to those presently concerned with land selections and evaluations, and to speculate on areas where undiscovered mineral resources may exist. GRA

N76-21675*# California Earth Science Corp., Santa Monica.
APPLICATION OF SKYLAB AND ERTS IMAGERY TO FAULT TECTONICS AND EARTHQUAKE HAZARDS OF PENINSULAR RANGES, CALIFORNIA; SOUTHWESTERN Final Report
D. L. Lamar and P. M. Merifield Jul. 1975 73 p refs Sponsored by NASA and Geol. Surv., Menlo Park, Calif.
(Contracts DI-14-08-001-13911; NAS2-7698)
(NASA-CR-146985; PB-247896/4; TR-75-2; USGS-LI-75-010) Avail: NTIS HC $4.50 CSCL 08G

Prominent linears in basement terrane of the Peninsular Ranges, southwestern California, appear on Skylab and ERTS images. Those most prominent are formed by active fault zones. Those not well defined have less horizontal displacements suggesting distinctness on the imagery may be related to amount of horizontal slip. Field investigations aided by study of large scale aerial photos were accomplished to determine the geologic characteristics of other linears and the earthquake generating potential of previously unmapped faults. The available data about newly uncovered faults is that they are inactive and therefore are not likely to generate earthquakes. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N76-21676*+ New Mexico Univ., Albuquerque. Technology Application Center.
SOLAR THERMAL ENERGY UTILIZATION: A BIBLIOGRAPHY WITH ABSTRACTS Semiannual Update, Jul. - Dec. 1974
Aug. 1975 361 p Sponsored by NASA
(NASA-CR-146804; TAC-ST74-601) Avail: NTIS for foreign requesters only. Domestic orders, Univ. of New Mexico, Tech. Application Center, Albuquerque HC $37.50 CSCL 10A

This bibliography cites and abstracts literature devoted to the practical thermal utilization of solar energy published between 1957 and June 1974. Introductory articles, overviews and economic considerations are identified in Section I; materials on solar and atmospheric radiative property data are abstracted in Sections 2 and 3 respectively. Section 4 is devoted to individual components, such as collectors, flat plates, concentrators, coolers, and thermal storage. Thermal characteristics of buildings and of solar heating-cooling systems are covered in Section 5, process heat applications in Section 6, and power generation in Section 7. Access points are provided by a table of contents, permuted title index, permuted subject index, author index, and corporate source index. Author

N76-21677*# Institute of Gas Technology, Chicago, Ill.
A PRELIMINARY SYSTEMS-ENGINEERING STUDY OF AN ADVANCED NUCLEAR-ELECTROLYTIC HYDROGEN-PRODUCTION FACILITY Final Report
William J. D. Escher, Timothy D. Donakowski, and Raymond R. Tison Dec. 1975 101 p refs
(Contract NAS8-30757; IGT Proj. 8962)
(NASA-CR-144230) Avail: NTIS HC $5.50 CSCL 10B

An advanced nuclear-electrolytic hydrogen-production facility concept was synthesized at a conceptual level with the objective of minimizing estimated hydrogen-production costs. The concept is a closely-integrated, fully-dedicated (only hydrogen energy is produced) system whose components and subsystems are predicted on "1985 technology." The principal components are: (1) a high-temperature gas-cooled reactor (HTGR) operating a helium-Brayton/ammonia-Rankine binary cycle with a helium reactor-core exit temperature of 980 C, (2) acyclic d-c generators, (3) high-pressure, high-current-density electrolyzers based on solid-polymer electrolyte technology. Based on an assumed 3,000 MWt HTGR the facility is capable of producing 8.7 million std cu m/day of hydrogen at pipeline conditions, 6,900 kPa. Coproduct oxygen is also available at pipeline conditions at one-half this volume. It has further been shown that the incorporation of advanced technology provides an overall efficiency of about 43 percent, as compared with 25 percent for a contemporary nuclear-electric plant powering close-coupled contemporary industrial electrolyzers. Author

N76-21678*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Applied Mechanics Div.
ON THE THERMOELASTIC ANALYSIS OF SOLAR CELL ARRAYS AND RELATED MATERIAL PROPERTIES
M. A. Salama and F. L. Bouquet 15 Feb. 1976 87 p refs
(Contract NAS7-100)
(NASA-CR-146579; JPL-TM-33-753) Avail: NTIS HC $5.00 CSCL 10A

Accurate prediction of failure of solar cell arrays requires accuracy in the computation of thermally induced stresses. This was accomplished by using the finite element technique. Improved procedures for stress calculation were introduced together with failure criteria capable of describing a wide range of ductile and brittle material behavior. The stress distribution and associated

failure mechanisms in the N-interconnect junction of two solar cell designs were then studied. In such stress and failure analysis, it is essential to know the thermomechanical properties of the materials involved. Measurements were made of properties of materials suitable for the design of lightweight arrays: microsheet-0211 glass material for the solar cell filter, and Kapton-H, Kapton F, Teflon, Tedlar, and Mica Ply PG-402 for lightweight substrates. The temperature-dependence of the thermal coefficient of expansion for these materials was determined together with other properties such as the elastic moduli, Poisson's ratio, and the stress-strain behavior up to failure. Author

N76-21679*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CLOSED CYCLE MHD POWER GENERATION EXPERIMENTS USING A HELIUM-CESIUM WORKING FLUID IN THE NASA LEWIS FACILITY

Ronald J. Sovie 1976 11 p refs Proposed for presentation at Fifteenth Symp. on the Eng. Aspects of Magnetohydrodynamics, Philadelphia, 24-26 May 1976

(NASA-TM-X-71885; E-8660) Avail: NTIS HC $3.50 CSCL 10A

A MHD channel, which was previously operated for over 500 hours of thermal operation, ten thermal cycles, and 200 cesium injection tests, was removed from the facility and redesigned. The cross sectional dimensions of the channel were reduced to 5 by 16.5 cm to allow operation over a variety of conditions. The redesigned channel has been operated for well over 300 hours, 10 thermal cycles, and 150 cesium injection tests with no problems. Experiments have been run at temperatures of 1900-2100 K and Mach numbers from 0.3 to 0.55 in argon and 0.2 in helium. The best results to date have been obtained in the helium tests. Power outputs of 2.2 kw for tests with 28 electrodes and 2.1 kw for tests with 17 electrodes were realized. Power densities of 0.6 MW/cu m and Hall fields of about 1,100 V/m were obtained in the tests with 17 electrodes. Author

N76-21680# Committee on Aeronautical and Space Sciences (U. S. Senate).

SOLAR POWER FROM SATELLITES

Washington GPO 1976 232 p refs Hearings before Subcomm. on Aerospace Technol. and Natl. Needs of Comm. on Aeron. and Space Sci., 94th Congr., 2d Sess., 19 and 21 Jan. 1976

(GPO-66-608) Avail: SOD HC $2.70

Advanced aerospace technology that might supply future sources of energy is considered. Emphasis is placed on ways to collect solar power in space with satellites and to beam the power down to earth to supplement other sources of electricity. Novel approaches to construction of those satellites are also discussed. J.M.S.

N76-21681*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THIRD WORKING MEETING ON GALLIUM ARSENIDE SOLAR CELLS

Gilbert H. Walker, comp. Mar. 1976 189 p refs Meeting held at Hampton, Va., 25-26 Sep. 1975

(NASA-TM-X-72819) Avail: NTIS HC $7.50 CSCL 10A

Research results are reported for GaAs Schottky barrier solar cells, GaAlAs/GaAs heteroface solar cells, and GaAlAs graded band gap solar cells. Related materials studies are presented. A systems study for GaAs and Si solar concentrator systems is given. Author

N76-21682*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RESULTS AND PROGRESS ON THE NASA LEWIS H2-O2 MHD PROGRAM

J. Marlin Smith 1976 8 p refs Presented at 15th Symp. on the Eng. Aspects of Magnetohydrodyn., Philadelphia, 24-26 May 1976

(NASA-TM-X-71891; E-8675) Avail: NTIS HC $3.50 CSCL 10A

It was found that flame sprayed ceramic coatings on combustion chamber and nozzle walls permit operation with hot walls, thereby eliminating possible problems associated with seed condensation. However, under the conditions of experiment the net heat transfer was unexpectedly increased over that of cold copper walls. Pressure disturbances associated with oblique pressure waves were measured in a MHD channel. These disturbances are due to a rocket-type nozzle which was designed to achieve low weight rather than perfectly parallel flow at the exit. A new nozzle with parallel flow at the exit was designed. Electrical conductivity measurements agreed well with theory except at low combustion pressures and/or high ratios of seed/oxygen mass flows (seed was injected into oxygen flow line). The discrepancy is believed to be the result of poor atomization of the seed at high ratios of seed/oxygen mass flows which results in droplet sizes which do not completely vaporize the combustor. Author

N76-21683*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LARGE EXPERIMENTAL WIND TURBINES: WHERE WE ARE NOW

Ronald L. Thomas 1976 32 p refs Presented at 3d Energy Technol. Conf./Exposition, Washington, D. C., 29-31 Mar. 1976; sponsored by Government Inst., Inc.

(NASA-TM-X-71890; E-8674) Avail: NTIS HC $4.00 CSCL 10B

Several large wind turbine projects have been initiated by NASA-Lewis as part of the ERDA wind energy program. The projects consist of progressively large wind turbine ranging from 100 kW with a rotor diameter of 125 feet to 1500 kW with rotor diameters of 200 to 300 feet. Also included is supporting research and technology for large wind turbines and for lowering the costs and increasing the reliability of the major wind turbine components. The results and status of the above projects are briefly discussed in this report. In addition, a brief summary and status of the plans for selecting the utility sites for the experimental wind turbines is also discussed. Author

N76-21684# Committee on Science and Technology (U. S. House).

ENERGY FACTS, 2

Winifred Griffin Smith Washington GPO Aug. 1975 542 p refs Presented to Subcomm. on Energy Res., Develop., and Demonstration of the Comm. on Sci. and Technol., 94th Congr., 1st Sess., Aug. 1975 Prepared by the Library of Congr., Congr. Res. Service

(GPO-53-136) Avail: SOD HC $4.55

Energy Facts 2 contains a comprehensive selection of United States and foreign energy statistics. It also includes statistical tables on most common and some unconventional energy sources. Care has been taken to select tables that contain the most recent and best organized information available from primary sources. The statistical tables and graphs are grouped by resources, production, consumption and demand, energy and gross national product, research and development, and other categories. Author

N76-21685*# North Carolina State Univ., Raleigh. Electrical Engineering Dept.

A THEORETICAL STUDY OF HETEROJUNCTION AND GRADED BAND GAP TYPE SOLAR CELLS Annual Report

J. R. Hauser and J. E. Sutherland Mar. 1976 63 p refs (Grant NsG-1116)

(NASA-CR-146840) Avail: NTIS HC $4.50 CSCL 10A

The theory of heterojunction and graded bandgap solar cells was studied to help determine the material compositions and device dimensions needed for high efficiency solar cells. Because of the involved analysis of the fundamental equations describing solar cell operation, a general numerical device analysis program was used. A major part of the initial work was involved in modifying an existing silicon solar cell analysis program to account for the unique features of graded bandgap and heterojunction solar cells. The most successful III-V solar cells have so far been constructed in the GaAs and Gal-xAlxAs material systems; this project was concerned with such solar cells. The most efficient solar cell so far evaluated is an abrupt heterojunction cell with a pure AlAs layer at the surface with a GaAs substrate. The predicted efficiency for this cell is slightly larger than that of a graded bandgap Gal-xAlxAs solar cell. Author

N76-21686*# Auburn Univ., Ala. School of Engineering.
ECASTAR: ENERGY CONSERVATION; AN ASSESSMENT OF SYSTEMS, TECHNOLOGIES AND REQUIREMENTS Final Report
Sep. 1975 757 p refs NASA/ASEE Systems Design Summer Faculty Program, 1975 Sponsored in part by FEA and ASEE (Grant NGT-01-003-044)
(NASA-CR-146859) Avail: NTIS HC $18.75 CSCL 10B

A methodology for a systems approach display and assessment of the potential for energy conservation actions and the impacts of those actions was presented. The U.S. economy is divided into four sectors: energy industry, industry, residential/commercial and transportation. Each sector is assessed with respect to energy conservation actions and impacts. The four sectors are combined and three strategies for energy conservation actions for the combined sectors are assessed. The three strategies (national energy conservation, electrification and diversification) represent energy conservation actions for the near term (now to 1985), the mid term (1985 to 2000) and the far term (2000 and beyond). The assessment procedure includes input/output analysis to bridge the flows between the sectors, and net economics and net energetics as performance criteria for the conservation actions. Targets of opportunity for large net energy net energy savings and the application of technology to achieve these savings are discussed. For individual titles, see N76-21687 through N76-21699.

N76-21687* Auburn Univ., Ala.
THE POLITICAL ECONOMY OF CONSERVATION
In its ECASTAR: Energy Conserv. Sep. 1975 10 p (For availability see N76-21686 12-44)
CSCL 10B

A political economic purview of energy conservation in the United States was delineated. The concepts of substitution and elasticity are distinguished, and further distinctions are made between short run price elasticity, cross price elasticity, and available fund elasticity. An assessment of the role which cost factors can play in conservation is given. The structure of the petroleum industry and foreign petroleum resources is discussed. Also discussed is the role of government, industry and the consumer with the economic sphere. Author

N76-21688* Auburn Univ., Ala.
CONSERVATION: TOWARD FIRMER GROUND
In its ECASTAR: Energy Conserv. Sep. 1975 10 p (For availability see N76-21686 12-44)
CSCL 10B

The following aspects of energy conservation were discussed: conservation history and goals, conservation modes, conservation accounting-criteria, and a method to overcome obstacles. The conservation modes tested fall into one of the following categories: reduced energy consumption, increased efficiency of energy utilization, or substitution of one or more forms of energy for another which is in shorter supply or in some sense thought to be of more value. The conservation accounting criteria include net energy reduction, economic, and technical criteria. A method to overcome obstacles includes (approaches such as: direct personal impact (life style, income, security, aspiration), an element of crisis, large scale involvement of environmental, safety, and health issues, connections to big government, big business, big politics, involvement of known and speculative science and technology, appeal to moral and ethical standards, the transient nature of opportunities to correct the system.Y.J.A.

N76-21689* Auburn Univ., Ala.
ECASTAR SYSTEMS APPROACH
In its ECASTAR: Energy Conserv. Sep. 1975 30 p (For availability see N76-21686 12-44)
CSCL 10B

The methodology of ECASTAR was presented and a discussion of the application of technology to energy conservation was given. This methodology constitutes an overview and blueprint for the analysis of energy conservation actions, and is subdivided into the following sections: the systems approach, constraints and criteria, application of the method (systems approach display, ECASTAR team, study phases and objectives, requirements and impacts, trade-off, integration, and feedback), an example of the method (technology applications). Author

N76-21690* Auburn Univ., Ala.
CONSERVATION IN THE ENERGY INDUSTRY
In its ECASTAR: Energy Conserv. Sep. 1975 11 p (For availability see N76-21686 12-44)
CSCL 10B

The basic energy supply and utilization problems faced by the United States were described. Actions which might alleviate the domestic shortfall of petroleum and natural gas are described, analyzed and overall impacts are assessed. Specific actions included are coal gasification, in situ shale oil production, improved oil and gas recovery, importation of liquid natural gas and deregulation of natural gas prices. These actions are weighed against each other as alternate techniques of alleviating or overcoming existing shortfalls. Author

N76-21691* Auburn Univ., Ala.
CONSERVATION AND THE INDUSTRY SECTOR
In its ECASTAR: Energy Conserv. Sep. 1975 14 p ref (For availability see N76-21686 12-44)
CSCL 10B

The following six highly energy intensive industries were studied as targets of energy conservation opportunity: food and kindred products, paper and allied products, chemicals and allied products, petroleum and coal products, stone, glass and clay products, and primary manufacturing. After studying conservation actions within each industry the actions were grouped under three broad categories: increased combustion efficiency, process improvement, and good housekeeping. Some of the results were: (1) approximately 2.18 quads could be saved in 1980 and 2.57 quads in 1985 by installing cogenerative facilities in 50% of the industries, (2) regenerative air-preheaters could result in a 10-15% increase in furnace efficiency representing a 15-25% fuel savings (2.3 to 3.9 quads in 1980 and 2.7 to 4.5 quads in 1985), (3) several major industries have potential for energy savings by recycling-aluminum (0.2 quads), steel (1 quad), glass (0.006 quads), paper and cement (0.08 quads). Y.J.A.

N76-21692* Auburn Univ., Ala.
ENERGY CONSERVATION AND THE TRANSPORTATION SECTOR
In its ECASTAR: Energy Conserv. Sep. 1975 26 p refs (For availability see N76-21686 12-44)
CSCL 10B

The present status of the energy implications of the transportation systems in the United States was illustrated, with primary emphasis on the technologies and methods for achieving a substantial reduction in the associated energy price (approximately 25% of the nation's energy is consumed directly in the operation of these systems). These technologies may be classified as follows: (1) improvement of system efficiency (system operations or technological), (2) substitution for scarce energy resources (electrification, alternate fuels, use of man power, recycling), (3) curtailment of end use (managed population growth rate, education of citizenry, alternatives to personal transportation, improved urban planning, reduced travel incentives). Examples and illustrations were given. Thirty-four actions were chosen on the basis of a preliminary filtering process with the objective of: (1) demonstrating a methodological approach to arrive at logical and consistent conservation action packages, (2) recommending a viable and supportable specific set of actions. Y.J.A.

N76-21693* Auburn Univ., Ala.
ENERGY CONSERVATION AND THE RESIDENTIAL AND COMMERCIAL SECTOR
In its ECASTAR: Energy Conserv. Sep. 1975 22 p refs (For availability see N76-21686 12-44)
CSCL 10B

A detailed analysis of energy conservation actions relevant to the residential and commercial sector has led to the conclusion that the potential for savings is great. The task will not be easy, however, since many of the actions require significant life style changes that are difficult to accomplish. Furthermore, many of the conservation actions cited as instant solutions to the energy crisis are those with only mid to long term potential, such as solar energy or heat pumps. Three significant conservation approaches are viable: adjusting price structure, mandating actions, and educating consumers. The first two appear to be the most feasible. But they are not without a price. Higher

utility bills adversely affect the poor and the elderly on fixed incomes. Likewise, strict mandatory measures can be quite distasteful. But the effect of alternatives, such as voluntary savings accomplished through education processes, is minimal in a nation without a true conservation ethic. Author

N76-21694* Auburn Univ., Ala.
INPUT-OUTPUT ANALYSIS OF SOME SECTOR ACTIONS
In its ECASTAR: Energy Conserv. Sep. 1975 16 p refs (For availability see N76-21686 12-44)
CSCL 10B

Selected energy conservation actions previously discussed in depth but separately in the areas of the energy industry, the industry sector, the transportation sector, and the residential and commercial sector, were brought together and assessed as a group. Particular emphasis was devoted to identifying secondary or indirect impacts and multiple interactions. Preliminary results obtained from the ECASTAR energy input-output model suggest that the impacts of energy conservation actions can be grossly misrepresented if secondary impacts are not included in the assessment. A methodology which stresses the importance of secondary and multiple interactions permeates the underlying philosophy of this discussion. Author

N76-21695* Auburn Univ., Ala.
NATIONAL ENERGY CONSERVATION
In its ECASTAR: Energy Conserv. Sep. 1975 33 p refs (For availability see N76-21686 12-44)
CSCL 10B

A set of energy conservation actions that cut across all sectors of the economy were analyzed so that all actions under consideration be analyzed systematically and as a whole. The actions considered were as follows: (1) roll back the price of newly discovered oil, (2) freeze gasoline production for 3 years at 1972 levels, (3) mandate automobile mileage improvements, (4) require industry to improve energy efficiency, (5) require manufacture of household appliances with greater efficiency, (6) force conversion of many power plants from gas and oil to coal. The results showed that considerable gas and oil would be saved by forcing switches to coal. However, the large scale switch to coal was shown to require greatly increased outputs from many other industries that in turn require more energy. It was estimated that nearly 2.5 quads of additional coal were needed to produce these additional requirements. Also, the indirect requirements would create more jobs. Author

N76-21696* Auburn Univ., Ala.
ELECTRIFICATION
In its ECASTAR: Energy Conserv. Sep. 1975 25 p refs (For availability see N76-21686 12-44)
CSCL 10B

Electrification was chosen for an assessment of conservation impact because it is almost the sole consumer of coal and nuclear power, and because electrical end use can be made to have higher overall efficiency than many present direct fuel uses. The important actions within electrification that were examined are those with the greatest impacts (coal and nuclear), the greatest technological requirements (peak shaving and transmission), and the greatest response from the decision makers (economic health and growth of utilities in an era of increasing energy costs.) A list of recommendations relating to the study of electrification was given. Author

N76-21697* Auburn Univ., Ala.
DIVERSIFICATION OF ENERGY SOURCES
In its ECASTAR: Energy Conserv. Sep. 1975 15 p refs (For availability see N76-21686 12-44)
CSCL 10B

The concept of energy source diversification was introduced as a substitution conservation action. The current status and philosophy behind a diversification program is presented in the context of a national energy policy. Advantages, disadvantages (constraints), and methods of implementation for diversification are discussed. The energy source systems for diversification are listed and an example impact assessment is outlined which deals with the water requirements of the specific energy systems. Author

N76-21698* Auburn Univ., Ala.
CITIZEN'S ACTIONS
In its ECASTAR: Energy Conserv. Sep. 1975 16 p (For availability see N76-21686 12-44)
CSCL 10B

The role played by individual citizens as consumers of energy was examined, with emphasis on studying ways in which their action could result in energy conservation. It was shown that there are ways that energy can be conserved in this way, with citizens acting either individually or in groups. The potential savings are significant, but the actual savings may be quite small. The citizens need to be motivated to save and to believe in a conservation ethic; developing such an ethic is difficult, and perhaps not responsive to the shotgun approach now being attempted. The true course of action may be to synthesize new societal structures that provide the maximum evolution of culture within the limitation of scarce energy resources. Author

N76-21699* Auburn Univ., Ala.
ECASTAR SUMMARY AND RECOMMENDATIONS
In its ECASTAR: Energy Conserv. Sep. 1975 13 p (For availability see N76-21686 12-44)
CSCL 10B

A methodology was presented for a systems approach to energy conservation, where conservation was depicted as the result of any action that improves the energy situation of the United States in the present and near future. The relevant constraints and criteria and their application were discussed. Among the most important are the present (capitalistic) structure of the American economy, the lead times necessary for implementation of relevant technologies, and the desire of most policymakers to maintain a reasonable standard of living with a reasonable amount of invulnerability to foreign discretion. The objective of the design group was the assessment of the potential and impact of conservation action in the United States. The U.S. economy was divided into four sectors: energy industry, industry, residential/commercial, and transportation. Each sector was analyzed for conservation actions and their impacts. The sector analysis was characterized as the system design or construction phase. Author

N76-21700*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE COMPUTER SIMULATION OF AUTOMOBILE USE PATTERNS FOR DEFINING BATTERY REQUIREMENTS FOR ELECTRIC CARS
Harvey J. Schwartz 1976 13 p refs To be presented at the 4th Intern. Elec. Vehicle Symp., Dusseldorf, 31 Aug. - 2 Sep. 1976; sponsored by Intern. Union of Producers and Distributors of Elec. Energy
(NASA-TM-X-71900; E-8689) Avail: NTIS HC $3.50 CSCL 10C

A Monte Carlo simulation process was used to develop the U.S. daily range requirements for an electric vehicle from probability distributions of trip lengths and frequencies and average annual mileage data. The analysis shows that a car in the U.S. with a practical daily range of 82 miles (132 km) can meet the needs of the owner on 95% of the days of the year, or at all times other than his long vacation trips. Increasing the range of the vehicle beyond this point will not make it more useful to the owner because it will still not provide intercity transportation. A daily range of 82 miles can be provided by an intermediate battery technology level characterized by an energy density of 30 to 50 watt-hours per pound (66 to 110 W-hr/kg). Candidate batteries in this class are nickel-zinc, nickel-iron, and iron-air. The implication of these results for the research goals of far-term battery systems suggests a shift in emphasis toward lower cost and greater life and away from high energy density. Author

N76-21701*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE REQUIREMENTS FOR BATTERIES FOR ELECTRIC VEHICLES
Harvey J. Schwartz 1976 7 p refs To be presented at the 27th Power Sources Symp., Atlantic City, 21-24 Jun. 1976
(NASA-TM-X-71916; E-8721) Avail: NTIS HC $3.50 CSCL 10C

Analysis of automobile use patterns shows that the battery requirements for an urban car can be met by mid-term battery technology. The far-term technology potentially offers greater range but does not proportionately increase the usefulness of the vehicle. This suggests that emphasis should be shifted toward more modest energy density goals, if such a shift would ease technical problems and allow the use of lower cost materials and construction methods. A technology diffusion model indicates that the impact of the mid-term batteries by the year 2000 would be greater than that of the far-term batteries because of their earlier introduction and nearly equal market potential. From the standpoint of maximizing both the cumulative impact and the benefits derived in the year 2000, however, a strategy of early introduction of near-term and mid-term cars followed by the far-term vehicle would produce the optimum results. Author

N76-21702*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MODEL FOR CALCULATING ELECTROLYTIC SHUNT PATH LOSSES IN LARGE ELECTROCHEMICAL ENERGY CONVERSION SYSTEMS
Paul R. Prokopius Washington Apr. 1976 14 p ref
(NASA-TM-X-3359; E-8501) Avail: NTIS HC $3.50 CSCL 10B

Generalized analysis and solution techniques were developed to evaluate the shunt power losses in electrochemical systems designed with a common or circulating electrolyte supply. Sample data are presented for a hypothetical bulk energy storage redox system, and the general applicability of the analysis technique is discussed. Author

N76-21703*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FABRICATION AND ASSEMBLY OF THE ERDA/NASA 100 KILOWATT EXPERIMENTAL WIND TURBINE
Richard L. Puthoff Washington Apr. 1976 30 p refs
(NASA-TM-X-3390; E-8663) Avail: NTIS HC $4.00 CSCL 10B

As part of the Energy Research and Development Administration (ERDA) wind-energy program, NASA Lewis Research Center has designed and built an experimental 100-kW wind turbine. The two-bladed turbines drives a synchronous alternator that generates its maximum output of 100 kW of electrical power in a 29-km/hr (18-mph) wind. The design and assembly of the wind turbine were performed at Lewis from components that were procured from industry. The machine was installed atop the tower on September 3, 1975. Author

N76-21704# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
DESIGN CORRELATION FOR PRESSURE DROPS IN COILED, ONCE-THROUGH STEAM GENERATORS
F. Campolunghi, M. Cumo, G. Ferrari, Z. Techy, and G. Vaccaro 1975 28 p
(RT/ING-(75)7) Avail: ERDA Depository Libraries HC $4.50

A two-phase pressure drop correlation for once-through coiled steam generators is suggested on the basis of a set of experimental data. The correlation employs the results of the well-known homogeneous model, corrected for both specific mass flowrate and pressure. Experimental results are reproduced within a plus or minus 10% error. Author (NSA)

N76-21705# Brookhaven National Lab., Upton, N.Y.
BROOKHAVEN PROGRAM TO DEVELOP A HELIUM-COOLED POWER TRANSMISSION SYSTEM
E. B. Forsyth 1975 45 p refs Presented at Conf. on Tech. Appl. of Supercondivity, Alushta, USSR, 16 Sep. 1975 Sponsored by NSF and ERDA
(BNL-20444; Conf-750950-1) Avail: NTIS HC $5.25

The particular system under design consists of flexible cables installed in a cryogenic enclosure at room temperature and cooled to the range 6 to 9 K by supercritical helium; contraction of the cable is accommodated by proper choice of helix angles of the components of the cable. The superconductor is Nb3Sn, and at the present time the dielectric insulation is still the subject of intensive development. Two good choices appear to be forms of polyethylene and polycarbonate. Sample cables incorporating various dielectrics have been manufactured commercially in lengths of 1,500 ft and tested in laboratory cryostats in shorter sections of about 70 ft. A test facility is under construction to evaluate cables and cryogenic components for this type of service, the first refrigerator uses a 350 H.P. screw compressor and three turbo-expander stages. It is hoped to achieve reliability of a very high order. The first three-phase tests will be conducted at 69 kV, although it appears that 230to 345 kV is the most likely voltage range for future applications. Author (NSA)

N76-21706# Los Alamos Scientific Lab., N.Mex.
USERDA DIVISION OF ELECTRIC ENERGY SYSTEMS dc SUPERCONDUCTING POWER TRANSMISSION LINE PROJECT AT LASL, 1 JANUARY - 31 MARCH 1975 Progress Report
W. E. Keller and R. D. Taylor Sep. 1975 23 p refs Sponsored by ERDA
(LA-6053-PR; PR-9) Avail: NTIS HC $4.00

The measured magnetic field profile near a superconducting tape carrying a current is explained by a simple model of the current distribution. The propagation velocity of a normal zone in a stabilized superconductor was measured and found to depend on the direction of the current flow. Some efficiency and cost factors of several possible designs for a dc superconducting power transmission line are compared with transmission line alternatives. Author (NSA)

N76-21707# Brookhaven National Lab., Upton, N.Y.
APPLICATION OF CONTROLLED THERMONUCLEAR REACTOR FUSION ENERGY FOR FOOD PRODUCTION
V. D. Dang and M. Steinberg Jun. 1975 52 p refs Presented at the 68th Ann. Meeting of Am. Inst. of Chem. Eng., Los Angeles, 16 Nov. 1975 Sponsored by ERDA
(BNL-20286; Conf-751107-7) Avail: NTIS HC $5.75

Food and energy shortages in many parts of the world in the past two years raise an immediate need for the evaluation of energy input in food production. The present paper investigates systematically (1) the energy requirement for food production; and (2) the provision of controlled thermonuclear fusion energy for major energy intensive sectors of food manufacturing. Among all the items of energy input to the food industry, fertilizers, water for irrigation, food processing industries, such as beet sugar refinery and dough making and single cell protein manufacturing, have been chosen for study in detail. A controlled thermonuclear power reactor was used to provide electrical and thermal energy for all these processes. Conceptual design of the application of controlled thermonuclear power, water and air for methanol and ammonia synthesis and single cell protein production is presented. Economic analysis shows that these processes can be competitive. Author (NSA)

N76-21708# Battelle Pacific Northwest Labs., Richland, Wash.
REVIEW AND EVALUATION OF INFORMATION ON THE THERMAL PERFORMANCE OF ULTIMATE HEAT SINKS: SPRAY PONDS AND COOLING PONDS
Ronald L. Drake Sep. 1975 280 p refs
(Contract AT(45-1)-1830)
(BNWL-B-446) Avail: NTIS HC $7.60

A report is presented which identifies and evaluates available information and data useful in validating and improving existing models for the thermal performance of ultimate heat sinks. Included are discussions of the thermal elements of cooling ponds and spray ponds, the available information and data pertinent to the problem, and the requirements and needs for further research and performance data. An outline is presented of the necessary elements required for a performance test of an ultimate heat sink before the system is thermally approved. Author (NSA)

N76-21709# Oak Ridge National Lab., Tenn.
NEUTRON ACTIVATION ANALYSIS APPLIED TO ENERGY AND ENVIRONMENT
W. S. Lyon 1975 13 p refs Presented at Conf. of Nucl. Power and Appl. in Latin Am., Mexico City, 29 Sep. 1975 Sponsored by ERDA
(CONF-750928-2) Avail: NTIS HC $4.00

Neutron activation analysis was applied to a number of problems concerned with energy production and the environment. Burning of fossil fuel, the search for new sources of uranium,

possible presence of toxic elements in food and water, and water, and the relationship of trace elements to cardiovascular disease are some of the problems in which neutron activation was used. Author (NSA)

N76-21710# Battelle Pacific Northwest Labs., Richland, Wash.
ENVELOPE OF CURRENT CTR POWERPLANT DESIGN CHARACTERISTICS
B. F. Gore 1975 6 p refs Presented at the Joint Meeting of the Am. Nucl. Soc. and the Atomic Ind. Forum, San Francisco, 16 Nov. 1975 Sponsored by ERDA
(BNWL-SA-5488; Conf-751101-33) Avail: NTIS HC $4.00

An envelope of characteristics of the ten current U.S. design concepts for D-T fueled CTR power plants is presented. Designs based upon both magnetic inertial plasma confinement are included. This envelope was defined for reference in environmental and economic analyses of the effects of extensive generation of electric power by CTR power plants. Author (NSA)

N76-21711# Energy Research and Development Administration, Washington, D.C. Div. of Controlled Thermonuclear Research.
THE 1974 REVIEW OF THE RESEARCH PROGRAM
Jan. 1975 168 p refs
(ERDA-39) Avail: NTIS HC $5.45

The role of the research program in controlled thermonuclear research, the activities that are contained within the research program, and summaries of the reports prepared by the study groups that analyzed the six activity areas that make up the research program are described. The recommendations by an overview panel are given. The recommendations are based on an analysis of the individual study group reports, consultations with CTR staff and field scientists, and on dependent review of CTR program plans and needs. In some cases the recommendations of the overview panel are identical with study group recommendations and in other cases they are not. Some recommendations by the overview panel take into account factors in information that go beyond that available to the study groups. The five year budget needed to accomplish the recommended research program is discussed. NSA

N76-21712# Energy Research and Development Administration, Washington, D.C. Div. of Reactor Research and Development.
STATUS OF CENTRAL STATION NUCLEAR POWER REACTORS: SIGNIFICANT MILESTONES
1 Apr. 1975 13 p
(ERDA-30(4/75)) Avail: NTIS HC $3.50

Information on U. S. power reactors is listed concerning the reactor type, electrical capacity (MW(e)), manufacturer, public announcement date, contract award date, construction permit and operating license application and issuance dates, initial criticality, first electrical production, fuel power, and commercial operation date. NSA

N76-21713# Federal Energy Administration, Washington, D.C. Office of Energy Conservation and Environment.
MASS TRANSIT AND ENERGY CONSERVATION
Mayo S. Stuntz Mar. 1975 9 p refs
(PB-246232/3; FEA/D-75/646) Avail: NTIS HC $3.50 CSCL 10B

This report discusses the energy conservation potential of improved mass transit, and the extent to which increased transit during funding will promote substantial energy conservation. This study considers trends in annual urban transportation demand from 1945 to 1974; transit improvements; relative efficiencies of urban transportation modes; energy savings; mass transit mode shift policies; energy conservation potential of various transportation policy actions; and the role of transit in society. GRA

N76-21714# Dow Chemical Co., Midland, Mich.
ISOTHERMAL SOLAR HEAT STORAGE MATERIALS
Semiannual Progress Report, Sep. 1974 - Jun. 1975
George A. Lane, John S. Best, E. Colin Clarke, Stevens Drake, David N. Glen, Steven W. Quigley, and Harold E. Rosson Jul. 1975 18 p refs Sponsored in part by ERDA
(Contract NSF C-906)
(PB-246342/0; NSF/RANN/SE/C-906/PR-75-2) Avail: NTIS HC $3.50 CSCL 10C

A group of over 200 potential phase change heat storage materials, melting from 10-90C was identified. Laboratory tests narrowed these to materials recommended for hot faucet water, hydronic heating, forced air heating, heat pump application, radiant wall panels, and stored cold systems. Several encapsulation methods were studied: micro-encapsulation, encapsulation of powders and granules, and macro-encapsulation. Micro-encapsulation of $CaCl_2.6H_2O$ in polyester resin has been successful, and development of wall, floor, and ceiling panels is under way. Macro-encapsulation in plastic film containers appears promising for hot air systems. GRA

N76-21715# Oklahoma Univ., Norman. Science and Public Policy Program.
ENERGY ALTERNATIVES: A COMPARATIVE ANALYSIS
May 1975 706 p refs Sponsored in part by FEA, Council on Environ. Quality, ERDA, EPA, FPC, Dept. of the Interior, and NSF
(PB-246365/1; FEA/D-75/661) Avail: NTIS HC $18.75 CSCL 10A

This report develops a methodology for systematically identifying, assessing, and comparing energy alternatives in environmental impact statements (EIS). The report provides descriptions and data on the major energy resource systems in the United States and suggests procedures for using these descriptions and data. The study consists of two major parts. Part I contains descriptions of the coal, oil shale, crude oil, natural gas, tar sands, nuclear fission, nuclear fusion, geothermal energy, hydroelectric power, organic wastes, and solar energy resource systems plus descriptions of electric power generation and energy consumption. Each resource system description contains data and information on energy efficiencies, environmental residuals and economic costs. Part II describes procedures for using the descriptions and data contained in Part I in systematically evaluating and comparing the residuals, efficiencies and economic costs of a proposed energy action and its alternatives, and suggests procedures for impact analyses. GRA

N76-21716# ESB, Inc., Yardley, Pa. Technology Center.
PRODUCTION AND ENGINEERING METHODS FOR CARB: TEK (TRADE NAME) BATTERIES IN FORK LIFT TRUCKS
Interim Report, Sep. 1974 - Feb. 1975
James C. Schaefer Mar. 1975 57 p refs
(Contract DAAK02-75-C-0035)
(AD-A018106; TC-6452) Avail: NTIS CSCL 10/3

The purpose of this program is to develop the manufacturing technology of the Carb Tek molten salt Li/Cl battery to the prototype level. This purpose is being accomplished by actually constructing cells on a pilot line, optimizing process steps, establishing quality control procedures, and engineering appropriate changes. The majority of the cell work is performed in a controlled argon atmosphere. Results show that the carbon selected for the cell cathode can develop the required 5 Whr/cubic inch even when damaged by stress cracks. Anode contamination and fabrication problems have been reduced by a new alloying technique. Cell yields are dependent on weld quality. GRA

N76-21717# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPUTATION OF A PLANE DUST FLAME ON THE BASIS OF A UNIDIMENSIONAL MATHEMATICAL MODEL
Urszula Pajewska and Jacek Zelkowski 17 Apr. 1975 22 p refs Transl. into ENGLISH from Archiwum Procesow Spalania (Poland), v. 4, no. 4, 1973 p 375-386
(AD-A017801; FTD-HC-23-1094-75) Avail: NTIS CSCL 13/1

A method of computation is presented for the expansion of a flame in a plane jet using a mathematical model of a dust-air flame. The computation is performed with the aid of a digital computer, utilizing the results of model experiments. An example is given of computation of the temperature distribution within the jet of a dust-gas mixture flowing into the combustion chamber of a large power boiler. The presented computation method facilitates a fuller analysis of the dust fired furnace than has previously existed. GRA

N76-21718# Texas Univ., Austin. Center for Energy Studies.
ELECTRIC POWER TRANSMISSION AND DISTRIBUTION SYSTEMS: COSTS AND THEIR ALLOCATION

Martin L. Baughman and Drew J. Bottaro Jul. 1975 47 p refs
(Grant NSF SIA-73-07871-A02)
(PB-247189/4; CES-6; NSF/RA/N-75-107) Avail: NTIS HC $4.00 CSCL 10B

Transmission and distribution costs contribute significantly to the total costs of providing electrical service. The costs derived from the transmission and distribution (T&D) system have historically comprised about 2/3 the costs of producing and delivering electricity to residential-commercial customers, and over 1/3 the total costs supplying electricity to large industrial customers. This report: (1) estimates the differences in transmission and distribution equipment required to serve industrial and residential-commercial customers and allocates to the above two customer classes the average costs of installing this equipment; (2) estimates the costs of operation and maintenance of the transmission and distribution system, and allocates these costs to the customer classes; and (3) calculates the T&D derived average costs for the two customer classes. GRA

N76-21719# Electric Power Research Inst., Palo Alto, Calif. Environment and Conservation Div.
SIGNIFICANCE OF ZERO POWER GROWTH IN 1974
Milton F. Searl Sep. 1975 22 p refs
(PB-247517/6; EPRI-SR-17) Avail: NTIS HC $3.50 CSCL 10A

For the first time since 1946, the total electricity supply in 1974 did not increase appreciably over the preceding year. Two simple historical growth models are used to evaluate the significance of this occurrence. One relates total electricity made available to aggregate economic activity (real GNP) and the other relates it to the passage of time. In both models, electricity supply is highly correlated with the independent variable. On the basis of the economic model, there is no reason to believe that the rate of long-term growth of electricity relative to real GNP has declined; in fact, the contrary is indicated. Use of the other model, in which time is the independent variable, leads to exactly opposite conclusions. GRA

N76-21720# Mitre Corp., McLean, Va.
ENERGY RESOURCES FOR THE YEAR 2000 AND BEYOND, WITH SCENARIOS FOR THE YEAR 2000 AND THE YEAR 2100
Charles A. Zraket Mar. 1975 55 p refs Presented at Conf. on Towards a Plan of Action for Mankind, Needs, and Resources, Paris, 9-13 Sep. 1974
(PB-247413/8; MTP-401-Rev-2) Avail: NTIS HC $4.50 CSCL 10A

The following topics are discussed: current and projected World use of energy resources; energy sources and environmental effects; two scenarios for the year 2000 and the year 2100; new techniques for energy generation and transmission; the transportation sector. GRA

N76-21721# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEW DEVELOPMENTS IN THE AREA OF MAGNETOHYDRODYNAMIC CURRENT GENERATORS
P. K. Fritzer 17 Apr. 1975 21 p refs Transl. into ENGLISH from Elektrotech. Maschinenbau (Berlin), v. 91, no. 3, Mar. 1974 p 123-129
(AD-A017803; FTD-HC-23-1105-75) Avail: NTIS CSCL 10/2

Multidimensional coupled computations of channel flow are considered. Factors discussed include: hall effect and cross velocity; meaning of the boundary conditions-viscosity for stabilizing a channel flow; and heat transfer. Results of the investigation are summarized. J.M.S.

N76-21722# Army Electronics Command, Fort Monmouth, N.J.
COULOMBIC CAPACITIES OF CARBON CATHODES IN LITHIUM-THIONYL CHLORIDE CELLS
John A. Christopulos and Sol Gilman Nov. 1975 34 p refs
(DA Proj. 1S7-62705-AH-94)
(AD-A018024; ECOM-4365) Avail: NTIS CSCL 10/3

For lithium-thionyl chloride cells utilizing Teflon-bonded carbon cathodes, the attainable energy decreases with decreasing temperature and increasing rate of discharge. The losses correspond largely to decreases in the apparent coulombic capacities of the cathodes. The cathode capacity appears to depend directly on the overall porosity of the electrode rather than on the surface area of the carbon. At room temperature, cathode end-of-life occurs when the clogging of pores with product lithium chloride causes a sharp rise in concentration polarization. The clogging of cathode pores occurs earlier at low temperature, likely due to the precipitation of another reaction product, perhaps sulfur. Author (GRA)

N76-21723# Massachusetts Univ., Amherst. Energy Alternatives Program.
ON THE MINIMIZATION OF THE OCEAN THERMAL DIFFERENCES MACHINE VEHICLE SEA MOTIONS
Bruce A. Johnson and Clayton R. Adams Aug. 1975 67 p refs
(Grant NSF GI-34979)
(PB-247176/1; NSF/RANN/SE/GI-34979/TR-75-11; NSF/RA/N-75-121) Avail: NTIS HC $4.50 CSCL 13J

This report presents the results of the first phase of study of sea motions of pitch and heave of the Ocean Thermal Differences Machine Vehicle in the surfaced condition. Preliminary theory indicates the excitations for these motions are functions of the vehicle cross section and the vehicle length. Several vehicle parameters are then varied and the resulting seaway motions are calculated in an effort to find the configuration that achieves the least motion. The total motion for all frequency components of a seaway spectrum is calculated, and a figure of merit developed for minimum motion. GRA

N76-21724# Minnesota Univ., Minneapolis. Dept. of Management Sciences.
REIS: PHASE 2. REPORT 1: AN OVERVIEW OF THE REIS SYSTEM Draft Report
Norman L. Chervany, J. David Naumann, and Ronald D. Visness 31 Jul. 1975 69 p refs
(PB-248052/3; MEA/REIS-P2-7507) Avail: NTIS HC $4.50 CSCL 05B

The Regional Energy Information System (REIS) is being designed and implemented to collect, organize, store, and report data from the energy supply/distribution/consumption chain in the state of Minnesota. This system will contain; identification data, energy flow data, and end use data. The REIS system will allow users to have access to the data base in a variety of ways (i.e., periodic reporting, special request reporting, direct access/browsing capabilities, and the creation of machine readable files). The self-contained language feature of SYSTEM 2000 gives the REIS system the flexibility and evolvability necessary to meet the changing data needs of energy management problems. GRA

N76-21725# Control Data Corp., Palo Alto, Calif. Structural Engineering Services.
EXPLORATORY DISCUSSIONS CONCERNING A POSSIBLE EPRI/KURCHATOV INSTITUTE JOINT PROGRAM ON FUSION POWER
C. P. Ashworth, B. D. Fried, and W. C. Wolkenhauer Nov. 1975 50 p refs Sponsored by Elec. Power Res. Inst.
(PB-247269-4; EPRI-SR-24) Avail: NTIS HC $4.00 CSCL 18A

Meetings were held between EPRI and a Soviet delegation to discuss fusion power. The first meeting took place at EPRI in May 1975 at which the Soviet delegation stated their position as being that the highest priority goal is the development of a hybrid fusion-fission reactor based on a Tokamak. The Soviets consider fusion power to be the most realistic approach to the earliest possible implementation of controlled fusion energy production. The Soviet delegation expressed a strong interest in a formal inclusion of EPRI in the U.S.-U.S.S.R. collaborative program in controlled fusion. To answer difficult technical and procedural questions in anticipation of a joint venture, EPRI met the Soviet delegation in the U.S.S.R. in September. The report describing these meetings and giving the EPRI delegation's summary, evaluation, and recommendation is given together with a summary of the meeting jointly drafted by the U.S. and U.S.S.R. participants. GRA

N76-21726# Washington Univ., St. Louis, Mo. Center for the Biology of Natural Systems.
THE VULNERABILITY OF CROP PRODUCTION TO ENERGY PROBLEMS

Barry Commoner, Michael Gertler, Robert Klepper, and William Lockeretz Apr. 1975 40 p ref
(Grant NSF GI-043890)
(PB-247756/0; CBNS-AE-2; NSF/RA/N-75-164) Avail: NTIS HC $4.00 CSCL 02C

The energy consumed in producing 14 field crops under a variety of conditions is determined. The cost of this energy in both 1970 and 1974 is also calculated. For each crop, the impact of energy price increases is expressed through two indexes involving the increased amount paid for energy to produce one unit of crop. In the first index, this is compared to the increase in the total direct production cost; in the second index, it is compared to the increase in the price received per unit of crop in the same period (1970-1974). GRA

N76-21727# Minnesota Energy Agency, St. Paul. Research Div.
ENERGY REQUIREMENTS IN MINNESOTA IRON ORE AND TACONITE MINING 1953 - 2000
Howard Hirsch Aug. 1975 38 p refs
(PB-248055/6; MEA-MINE-7508) Avail: NTIS HC $4.00 CSCL 08I

This report is concerned primarily with forecasting energy requirements for taconite and iron mining in Minnesota until 2,000, and additionally with the role in the industry in the economy of both the State and the three-county Iron Range region of northeastern Minnesota. Direct energy inputs in iron mining in 1973 are related to three end-use categories: production, transportation, and overhead activities. Over 85 percent of direct energy consumed was for production activities. Transportation and overhead accounted for 6.74 and 7.91 percent of direct energy use respectively. GRA

N76-21728# Federal Energy Administration, Washington, D.C. Office of Environmental Programs.
ENERGY INDEPENDENCE ACT OF 1975 AND RELATED TAX PROPOSALS
Mar. 1975 392 p refs
(PB-247305/6; FEA/D-75/698) Avail: NTIS HC $10.75 CSCL 10A

It describes and analyzes the social, economic, and environmental impacts that may result from legislative programs. It examines the impacts that may result from each individual legislative porposal and from the energy program as a whole. Assessments of legislative proposals are organized into five sections: description of proposal, energy impacts, socioeconomic impacts, environmental impacts, and a presentation of reasonable alternatives to the proposed program and a description of their major environmental impacts. GRA

N76-21729# National Bureau of Standards, Washington, D.C. Center for Building Technology.
ENERGY CONSERVATION POTENTIAL OF MODULAR GAS-FIRED BOILER SYSTEMS Final Report
G. E. Kelly and D. A. Didion Dec. 1975 57 p refs
(PB-247205/8; NBS-BSS-79; LC-75-619338) Avail: NTIS HC $4.50 CSCL 13A

Four of the boilers, each having an input rating of 85,000 Btu per hour, were arranged so that they could either be operated like a single boiler (i.e., all of the boilers either on or off) or as a modular installation in which the boilers are sequentially fired to match the number in operation with the heating load. The fifth boiler had an input rating of 300,000 Btu per hour and was operated as a single boiler installation. Efficiency vs. heating load curves were obtained for the single boiler installation, the four small boilers ran like a single boiler and the modular installation operated with and without water flowing through the idle modules. GRA

N76-21730# National Bureau of Standards, Washington, D.C. Center for Building Technology.
RETROFITTING A RESIDENCE FOR SOLAR HEATING AND COOLING: THE DESIGN AND CONSTRUCTION OF THE SYSTEM
James E. Hill and Thomas E. Richtmyer Nov. 1975 101 p refs
(PB-247482/3; NBS-TN-892) Avail: NTIS HC $5.50 CSCL 13A

During 1972 and 1973, the National Bureau of Standards conducted controlled laboratory tests on a factory-built four-bedroom house having a floor area of 110 sq m (1200 sq ft) equipped with a conventional gas furnace and central electric air conditioner incorporated into a forced air distribution system. During 1974, the house was moved onto the NBS grounds and a solar heating and cooling system was designed to be added to the house. Calculations were made to show that more than 75% of the yearly energy needs for heating, cooling, and supplying domestic hot water could be obtained from the sun. This report deals with the design and construction of the retrofitted system. It consists of 45 sq m (485 sq ft) of double-glazed, flat-plate solar collector, 5.7 cu m (1,500 gallons) of water storage, and a 10,000 W (3 ton) lithium bromide absorption air cooling unit. GRA

N76-21731# San Diego Gas and Electric Co., Calif.
TEST AND EVALUATION OF A GEOTHERMAL HEAT EXCHANGER Final Report
G. L. Lombard Sep. 1975 66 p Prepared for Electric Power Res. Inst.
(PB-247318/1; EPRI-376-FR) Avail: NTIS HC $4.50 CSCL 13A

A small-scale, tube-in-shell heat exchanger with four sections in series was tested with geothermal brine. The brine inlet temperature was approximately 355F and contained 14,500 ppm dissolved solids. Scale was deposited on the heat exchanger tubes as heat was extracted from the brine and caused the overall heat transfer coefficient to decrease with time. Tube materials tested were titanium, carbon steel, and 90% copper-10% nickel. Results indicate that scaling rate is primarily a function of brine velocity and tube material type, with some effects of temperature becoming apparent as the temperature approaches 150F. This indicated that the minimum brine exit temperature should be kept at 150F or higher and that the maximum practical brine velocity may be around 7 ft/sec in full-scale heat exchanger designs. Pressure loss in the brine side of the heat exchanger due to scale build-up was minor. Chemical cleaning removed the scale layer. GRA

N76-21732# Systems Control, Inc., Palo Alto, Calif.
ANALYSIS OF DISTRIBUTION RESEARCH AND DEVELOPMENT PLANNING Final Report
L. Isaksen Oct. 1975 187 p refs Sponsored by Elec. Power Res. Inst.
(PB-247897/2; EPRI-329-FR) Avail: NTIS HC $7.50 CSCL 13B

Three important areas of electric utility distribution system research were identified: (1) planning methods, (2) system surveilance and control, and (3) data file technology. This study developed information and factual data for use by EPRI in formulating research project descriptions and in making policy and operating decisions regarding the EPRI distribution system research plan the research topics identified address systems analysis research needs. The need for advanced equipment is recognized, but equipment-oriented R&D is not within the scope of this study. GRA

N76-21733# Illinois Univ., Champaign. Dept. of Civil Engineering.
BIOLOGICAL CONVERSION OF ORGANIC REFUSE TO METHANE Annual Progress Report, 1 Jul. 1974 - 30 Jun. 1975
John T. Pfeffer and Jon C. Liebman Sep. 1975 153 p refs
(Grant NSF GI-39191)
(PB-247751/1; UILU-ENG-75-2019;
NSF/RANN/SE/GI-39191/PR-75-2;
NSF/RA/N-75-131-75-116) Avail: NTIS HC $6.75 CSCL 21D

Urban solid wastes contain significant quantities of energy that can be reclaimed. Biological conversion of the organic refuse to methane by anaerobic fermentation is one mechanism by which this energy can be reclaimed. The results are given of an investigation of refuse fermentation at a thermophili operating temperature of 60C; of dewatering of the fermentor residue by vacuum filtration; and of pretreatment of the refuse by a hot-caustic process. Treatment requirements, for the centrate-

filtrate produced by dewatering of the residue are presented.
GRA

N76-21734# ICF, Inc., Washington, D.C.
SHORT-TERM COAL FORECAST, 1975 - 1980 Final Report
Aug. 1975 120 p refs
(Contract FEA-C-05-50099-00)
(PB-247073/0; FEA/G-75/494) Avail: NTIS HC $5.50 CSCL 21D

Estimates are provided for bituminous coal and lignite production, consumption and end-of-year stocks for 1975 through 1980. The report discusses the approach and data base used to develop the projections of 1975-1980 production, consumption and stock levels; estimates the price impacts of these projections; and discusses the uncertainties and sensitivities inherent in the projections.
GRA

N76-21735# Illinois Univ., Champaign. Center for Advanced Computation.
THE COAL FUTURE: ECONOMIC AND TECHNOLOGICAL ANALYSIS OF INITIATIVES AND INNOVATIONS TO SECURE FUEL SUPPLY INDEPENDENCE, APPENDIX B Final Report
Michael Reiber, Shao Lee Soo, and James Stukel May 1975 36 p refs
(Grant NSF GI-35821)
(PB-247679/4; UIUC-CAC-DN-75-163B; NSF/RA/N-75-037B) Avail: NTIS HC $4.00 CSCL 18E

Energy costs of mining, preparing, reprocessing, and disposing of fuel for an average 1,000 MWe nuclear power plant are discussed. This model plant is assumed to average one boiling water reactor (BWR) and two pressurized water reactors (PWR). The energy cost of materials needed to construct a boiling water reactor plant is also discussed.
GRA

N76-21736# Nevada Bureau of Mines and Geology, Reno.
EVALUATION OF GEOTHERMAL ACTIVITY IN THE TRUCKEE MEADOWS, WASHOE COUNTY, NEVADA
Richard L. Batemen and R. Bruce Scheibach 1975 46 p refs Prepared in cooperation with Nevada Univ., Reno
(Contract DI-14-31-0001-4028)
(PB-247297/5; NBMG-25; W76-01683) Avail: NTIS HC $4.00 CSCL 08G

Probable effects of thermal waters on overall ground-water conditions under a pattern of increasing development within the basin are estimated. All chemical quality and temperature data for thermal and nonthermal ground waters were assembled and subjected to various forms of analysis. Results were used to precisely delineate areas of geothermal occurrence and assess the probable results of induced mixing of poor-quality thermal and good-quality nonthermal ground waters. Past and present use of the local geothermal resource were inventoried and evaluated. The most frequent present use is for single residence heating employing geothermal wells and simple heat exchange systems.
GRA

N76-21737# Research Triangle Inst., Research Triangle Park, N.C.
RANN UTILIZATION EXPERIENCE. CASE STUDY NO. 15. NEW TECHNIQUES FOR GASIFYING COAL
A. Squires 1975 31 p refs Prepared in cooperation with City Univ. of New York
(Grant NSF C-927)
(PB-247259/5; NSF/RA/G-75-043) Avail: NTIS HC $4.00 also available in complete report and summary, PB-247243 HC $13.00 CSCL 07A

Since the use of fuel gas lessens the particulate pollution associated with the combustion of coal, improved methods of coal gasification are a high-priority national need. The specific objectives of this project are to provided a technical basis for pilot scale activities by industry on fast fluidized beds and agglomerating fluidized beds that either react coal with hydrogen or gasify coal or coke with air and steam. Dissemination of the research results is discussed.
GRA

N76-21738# University of South Florida, Tampa. Coll. of Engineering.
REPORT ON A WORKSHOP FOR ENERGY CONSERVATION IN SOUTHEAST INDUSTRIAL PLANTS Final Report
E. W. Kopp 30 Jun. 1975 55 p
(Grant NSF ENG-75-03005)
(PB-246651/4; NSF/ENG-75-03005) Avail: NTIS HC $4.50 CSCL 10A

The objective was to identify research areas which should lead to a more efficient use of energy in industrial and commercial plant operations. The program was designed to define the state-of-the-art of energy use in such industrial facilities by means of case study presentations and descriptions of ongoing research activities having potential for energy conservation in industrial plants. Results of the workshop regarding solutions to existing problems and identification of needed research are also reviewed.
GRA

N76-21739# Colorado Univ., Boulder. Dept. of Mechanical Engineering.
TRANSPORT OF MASS AND ENERGY IN POROUS MEDIA DUE TO NATURAL CONVECTION. THE GEOTHERMAL BASIN PROBLEM Progress Report
D. R. Kassoy 26 Mar. 1975 20 p refs
(Grant NSF AER-74-03429)
(PB-247087/0; CUMER-75-2; NSF/RA/N-75-118; PR-1) Avail: NTIS HC $3.50 CSCL 08G

Geological and geophysical field data are used to develop plausible models of the energy-mass transport systems in geothermal anomalies. The basic describing equations for saturated thermally-active elastic porous media are discussed in the context of modelling physical processes occurring in the geothermal environment. Progress in code development is considered. Calculations for heat and mass transport due to natural convection in model systems are described. The importance of using variable fluid properties is emphasized.
GRA

N76-21740# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
ELECTRIC POWER TRANSMISSION AND DISTRIBUTION SYSTEMS: COSTS AND THEIR ALLOCATION
Martin L. Baughman and Drew J. Bottaro Jul. 1975 45 p refs
(Grant NSF SIA-73-07871-A02)
(PB-247141/5; MIT-EL-75-020) Avail: NTIS HC $4.00 CSCL 10B

The costs derived from installing, operating, and maintaining the transmission and distribution system have historically comprised about 2/3 the total costs of producing and delivering electricity to residential-commercial customers, and over 1/3 the total costs of supplying electricity to large industrial customers. This paper estimates the costs of transmission and distribution for nine regions of the United States for the above two customer classes. These costs are detailed for six categories of equipment used in the transmission and distribution system and the contribution to the total cost of each equipment category is determined.
GRA

N76-21741# Little (Arthur D.), Inc., Cambridge, Mass.
ASSESSMENT OF FUELS FOR POWER GENERATION BY ELECTRIC UTILITY FUEL CELLS Final Report
R. P. Stickles, G. C. Sweeney, P. E. Mawn, and J. M. Parry Oct. 1975 320 p refs Sponsored by Elec. Power Res. Inst.
(PB-247216/5; EPRI-318-FR) Avail: NTIS HC $9.75 CSCL 10B

The relative cost of fuel supply options for the production and distribution of fuels suitable for fuel cells was assessed, including the supply alternatives of hydrogen, synthetic gas (hydrogen/carbon monoxide), methanol, naphtha, and raw energy sources for conversion to product fuels-petroleum, natural gas, coal and municipal solid waste. Comparative economics of fuel cell power systems from raw of primary fuel to electricity were developed based on forecasted energy prices for 1978-1990. The integration of on-site fuel conversion with the fuel cell power sections was considered to utilize waste heat and water from the stack. The integration of coal gasifiers with fuel cell plants was also investigated.
GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N76-21742* National Aeronautics and Space Administration. Pasadena Office, Calif.

INDICATOR PROVIDING CONTINUOUS INDICATION OF THE PRESENCE OF A SPECIFIC POLLUTANT IN AIR Patent

Charles G. Miller (JPL) and Ralph E. Bartera, inventors (to NASA) (JPL) Issued 23 Mar. 1976 5 p Filed 7 Nov. 1974 Supersedes N75-11308 (13 - 02, p 0171) Sponsored by NASA (NASA-Case-NPO-13474-1; US-Patent-3,945,801; US-Patent-Appl-SN-521817; US-Patent-Class-23-254E; US-Patent-Class-356-37; US-Patent-Class-250-574) Avail: US Patent Office CSCL 13B

A continuous HCl in-air indicator was developed which consists of a tube-like element with an inlet end through which a continuous stream of air containing HCl enters. The air flows downstream from the inlet end and exits the element's outlet end. Positioned between the element's inlet and outlet ends are first and second spaced apart photoelectric units, which are preferably positioned adjacent the inlet and outlet ends, respectively. Ammonia gas is injected into the air, flowing through the element, at a position between the two photoelectric units. The ammonia gas reacts with the HCl in the air to form ammonium chloride particles. The difference between the outputs of the two photoelectric units is an indication of the amount of HCl in the air stream. Official Gazette of the U.S. Patent Office

N76-21743*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A THERMOLUMINESCENT METHOD FOR AEROSOL CHARACTERIZATION

Edward R. Long, Jr. and Robert S. Rogowski Jan. 1976 10 p refs

(NASA-TM-X-72795) Avail: NTIS HC $3.50 CSCL 13B

A thermoluminescent method has been used to study the interactions of aerosols with ozone. The preliminary results show that ozone reacts with many compounds found in aerosols, and that the thermoluminescence curves obtained from ozonated aerosols are characteristic of the aerosol. The results suggest several important applications of the thermoluminescent method: development of a detector for identification of effluent sources; a sensitive experimental tool for study of heterogeneous chemistry; evaluation of importance of aerosols in atmospheric chemistry; and study of formation of toxic, electronically excited species in airborne particles. Author

N76-21744# Committee on Public Works (U. S. Senate).

DISPOSAL OF HAZARDOUS WASTES

Washington GPO 1974 91 p refs Rept. pursuant to Section 212 of Solid Waste Disposal Act, as amended, 93d Congr., 2d Sess., Jun. 1974 Prepared by EPA (GPO-34-158) Avail: Comm. on Public Works

Section 212 of the Solid Waste Disposal Act (P.L. 89-272) as amended required that the U.S. Environmental Protection Agency (EPA) undertake a comprehensive investigation of the storage and disposal of hazardous wastes. This document represents EPA's Report to the President and the Congress summarizing the Agency's investigations and recommendations in response to the congressional mandate. The findings are based on a number of contractual efforts and analyses by Agency staff carried out since the passage of the Resource Recovery Act of 1970. The first section of the report discussed the congressional mandate and the Agency's response to it. Next, the public health, technological, and economic aspects of the problem of disposing of hazardous wastes are reviewed. A section detailing the case for hazardous waste regulation follows. The report concludes with a discussion of implementation issues and a presentation of findings and recommendations. Author

N76-21745# Committee on Public Works (U. S. Senate).

THE IMPACT OF SECONDARY TREATMENT ON WASTES DISCHARGED INTO THE OCEAN

Washington GPO 1974 428 p refs Hearings before Subcomm. on Environ. Pollution of Comm. on Public Works, 93d Congr., 2d Sess., 18 Mar. 1974 (GPO-34-602) Avail: Subcomm. on Environ. Pollution

Testimony regarding deep ocean discharge of municipal sewage as it relates to the secondary treatment requirements of the Federal Water Pollution Control Act of 1972 is presented. Particular attention is given to this problem in Hawaii. For the purpose of evaluating the effects of sewage treatment on water quality, the results of waste water treatment programs in coastal cities of the Pacific States are presented, including Seattle (Puget Sound) and the San Francisco Bay Area. D.M.L.

N76-21746*# Bethune-Cookman Coll., Daytona Beach, Fla.

ENVIRONMENTAL MONITORING OF NORTH MERRITT ISLAND Annual Report, 1 Nov. 1974 - 31 Oct. 1975

P. Poonai 31 Oct. 1975 16 p refs (Grant NGR-10-022-001) (NASA-CR-146848) Avail: NTIS HC $3.50 CSCL 13B

The environmental impact of the space shuttle operation on North Merritt Island was studied mainly by means of color infrared photos and field visits. An attempt was also made to generate character maps of the Island using LANDSAT data with a view to decreasing the cost of monitoring and making the process more flexible in terms of rapid estimation of the extent of selected ground features. It seems possible that the IMAGE-100 output can be improved by using it in conjunction with software systems which are used for generating character maps. All the methods for generating maps show six main plant associations on North Merritt Island. It was shown that the six associations are related by ecological succession, merge into their neighbors in terms of component species and can be observed for changes in terms of component species. Author

N76-21747*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

RADIONUCLIDES IN CHESAPEAKE BAY SEDIMENTS

Philip J. Cressy, Jr. Washington Apr. 1976 22 p (NASA-TN-D-8196; G-7661) Avail: NTIS HC $3.50 CSCL 13B

Natural and manmade gamma-ray emitting radionuclides were measured in Chesapeake Bay sediments taken near the Calvert Cliffs Nuclear Power Plant site. Samples represented several water depths, at six locations, for five dates encompassing a complete seasonal cycle. Radionuclide contents of dry sediments ranged as follows: Tl-208, 40 to 400 pCi/kg; Bi-214, 200 to 800 pCi/kg; K, 0.04 to 2.1 percent; Cs-137 <5 to 1900 pCi/kg; Ru106, <40 to 1000 pCikg Co60, <1 to 27 pCi/kg. In general, radionuclide contents were positively correlated with each other and negatively correlated with sediment grain size. Author

N76-21748# Federal Aviation Administration, Washington, D.C.

AIR QUALITY IMPACT ANALYSIS OF A PROPOSED NORTH/SOUTH RUNWAY AT ANCHORAGE INTERNATIONAL AIRPORT Final Report

John E. Tigue and Larry K. Carpenter Dec. 1975 95 p refs (AD-A020169/9; FAA-RD-75-179) Avail: NTIS HC $5.00 CSCL 13/2

The impact of a proposed runway at Anchorage International Airport on local air quality was analyzed. A projection of 1978 air traffic conditions was made and the Airport Vicinity Air Pollution (AVAP) model was used to calculate the aircraft impact upon air quality both with and without the proposed runway. The AVAP model is a Gaussian-plume-type dispersion model that utilizes point, area, and line source formulations to simulate the airport system. The air quality impact is evaluated by comparing the air quality concentrations for separate cases. Typical Anchorage days where the meteorology is poor were selected such that rather poor air quality would result. The study indicates that the addition of the proposed runway does not make a significant impact upon the airport vicinity air quality; although areas of concern do exist on the airport itself. Author

N76-21749# Blue Ridge-Winkler Textiles, Bangor, Pa.

TREATMENT OF TEXTILE WASTEWATER BY ACTIVATED SLUDGE AND ALUM COAGULATION Environmental Protection Technology Series

Thomas L. Rinker Oct. 1975 216 p refs (Grant EPA-S-801192)

(PB-248142/2; EPA-600/2-75-055) Avail: NTIS HC $7.75 CSCL 13B

Results of a study are presented of the treatment of wastewater, from a textile mill producing synthetic knit fabric for the apparel and automotive markets, with a system combining biological (activated sludge) and chemical (alum coagulation) processes. The treatment consisted of: heat recovery; equalization; completely mixed activated sludge with sedimentation and nutrient supplement; and alum coagulation with sedimentation, polymer addition, and pH adjustment. The activated sludge process effectively removed degradable organics and ammonia nitrogen. The alum coagulation process effectively removed colloidal organics, suspended solids, orthophosphate, and certain metals. Costs of the systems are given. GRA

N76-21750# Chemical Construction Corp., New York.
THE MAGNESIA SCRUBBING PROCESS AS APPLIED TO AN OIL-FIRED POWER PLANT Final Report, Jun. 1970 - Jun. 1974
George Koehler and James A. Burns (Boston Edison Co.) Oct. 1975 267 p refs
(Contract CPA-70-114)
(PB-247201/7; EPA-600/2-75-057) Avail: NTIS HC $9.00 CSCL 07A

A magnesia wet scrubbing system is reported for flue gas desulfurization on an oil fired, 150 MW generating unit. The project involved: design and construction of both an SO2 removal system (based on firing 2.5% sulfur fuel) and an MgO regeneration facility for 50 ton/day acid production; and operation of both plants over a 2 year period. The report shows that the system removed 90% of the inlet SO2 and controlled particulate emissions from the generating station, where 4,000 hours of operation were logged. Regenerated magnesia was recycled successfully and over 5,000 tons of acid was marketed from the regeneration plant, demonstrating the feasibility of the process. GRA

N76-21751# Atlantic Richfield Hanford Co., Richland, Wash.
AERIAL GAMMA SURVEY BY HELICOPTER TO MEASURE SURFICIAL CONTAMINATION
L. E. Bruns Mar. 1975 20 p refs
(Contract AT(45-1)-2130)
(ARH-SA-226) Avail: NTIS HC $4.00

A program was carried out to determine whether aerial gamma surveys could adequately measure the activity of high specific activity gamma emitters contaminating large land surface areas. The survey successfully measured the Cs-137 activity and the total gross gamma over areas from less than 1 to 20 sq km. Also, Am-241 was successfully measured over areas wherein the Cs-137 was sufficiently low. Microcuries per sq m were measured as low as 0.1 for Cs-137 and Am-241. Other radionuclides such as Co-60 were also detected. An aerial neutron survey was tried, though its efficiency limited detection to areas having more than 10 kg Pu per 4,000 sq m. It was concluded that the aerial survey can analyze a complete area, thereby saving millions of dollars in statistical sampling and analytical programs. Author (NSA)

N76-21752# Brookhaven National Lab., Upton, N.Y.
SAVANNAH RIVER LABORATORY LONG-TERM WASTE STORAGE PROGRAM Progress Report, Oct. - Dec. 1974
P. Colombo, M. Steinberg, and B. Manowitz Jan. 1975 30 p refs Sponsored by ERDA
(BNL-19673; PR-8) Avail: NTIS HC $4.50

The information given is part of a study at Brookhaven National Laboratory (BNL) in support of the Savannah River Laboratory (SRL) development program for long-term engineered storage of solidified high-level radioactive wastes. The FY 1975 BNL program objectives are (1) the preparation of appropriate formulations of cements with synthetic sludges, synthetic slurries and zeolites and, (2) an evaluation of the properties of the radwaste-concrete composite materials. The emphasis is placed on the development of cement-concrete composites containing cesium loaded zeolites and slurries. Author (NSA)

N76-21753# Brookhaven National Lab., Upton, N.Y.
DEVELOPMENT OF DURABLE LONG-TERM RADIOACTIVE WASTE COMPOSITE MATERIALS Progress Report, Jan. - Mar. 1975
P. Colombo Apr. 1975 23 p Sponsored by ERDA
(BNL-20009; PR-10) Avail: NTIS HC $4.25

Process design development for aqueous nitrate wastes has continued with an emphasis on mixing techniques. In-drum mixing by an end-over-end tumbling technique is currently viewed as the most viable option. The effect of the method of absorbent addition on cesium retention in cement concrete has also been studied. Leach testing of prospective cement concrete and polymer impregnated concrete formulations has demonstrated cesium and strontium leach rates of as low as 1.8 x 10 to the 7th power g/sq cm day after 73 days. The kinetics of cesium and strontium adsorption by Linde AW-500 zeolite and Fe(OH)3-MnO2 respectively were investigated. Calcine produced from simulated AGNS ILLW waste was analyzed for cesium, strontium, nitrate, and potassium content in preparation for leach testing. The compressive strengths of calcium aluminate diatomaceous earth cement concretes were measured in a continuing effort to optimize formulations for the disposal of BNL low level radioactive waste. Author (NSA)

N76-21754# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
EVALUATION OF GLASS AS A MARTIX FOR SOLIDIFICATION OF SAVANNAH RIVER PLANT WASTE Nonradioactive and Tracer Studies
J. A. Kelley May 1975 28 p refs
(Contract AT(07-2)-1)
(DP-1382) Avail: NTIS HC $4.00

One option for long-term management of Savannah River Plant high-activity waste is solidification and storage in a retrievable surface storage facility to be located on the plantsite. It is demonstrated that SRP waste can be incorporated into a borosilicate glass at 1150 C. Tests with simulated waste indicate that alkaline sludge stored in SRP waste tanks can be solidified in borosilicate glass containing up to 45 wt. percent sludge. For melting at 1150 C, the optimum glass mixture is 52.5 wt. percent SiO2, 10.0 percent B2O3, 22.5 percent Na2O, 5.0 percent CaO, and 10.0 percent TiO2. Author (NSA)

N76-21755# Energy Research and Development Administration, Washington, D.C.
ENVIRONMENTAL IMPACT OF TRANSPORTATION OF NUCLEAR MATERIALS IN THE LMFBR PROGRAM
May 1975 166 p refs
(ERDA-40) Avail: NTIS HC $5.45

A general analysis of the predicted environmental impact from the shipment of radioactive materials in the LMFBR fuel cycle is presented. The analysis is based on quantities of materials that would be required to maintain one 1000-MWe LMFBR in operation for one year. The materials considered in this analysis are divided into three categories: unirradiated fuel materials and assemblies, irradiated fuel, and waste. Author (NSA)

N76-21756# Battelle Pacific Northwest Labs., Richland, Wash.
IN-SITU X-RAY FLUORESCENCE SYSTEM DESIGN
H. G. Rieck, J. R. Kosorok, R. W. Perkins, and N. A. Wogman Apr. 1975 13 p
(Contract AT(45-1)-1830)
(BNWL-B-394) Avail: NTIS HC $5.45

The objective is to develop the capability for the real-time measurement of trace element and radionuclide pollutants in marine sediments. The technology discussed in this report permits the rapid mapping of the distribution of these pollutants in the surficial and bulk sediments. Author (NSA)

N76-21757# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
THE HYDRODYNAMIC AND PHYSICO-CHEMICAL BASIS OF THE DROP PICTURE METHOD
H. J. Smith Apr. 1975 128 p refs
(Rept-8/1975) Avail: NTIS HC $6.00; Max-Planck-Inst. fuer Stroemungsforsch., Goettingen, West Ger. DM 30.60

The effects of several instrumental and material parameters on the forms of drop pictures, used principally for water quality assessment, are reviewed and extended. The instrumental parameters include the liquid layer thickness, the size and fall height of the drops, the fall rate, and the temperature. The important material parameters are surface tension, viscosity,

density, and diffusion coefficient. The main hydrodynamic factors involved are summarized. Values quoted earlier for surface tension and viscosity of various solutions were found to be inconsistent so that remeasurement of many solutions was necessary. ESA

N76-21758# Abcor, Inc., Cambridge, Mass.
SUMMARY REPORT ON MODELING ANALYSIS OF SELECTED POWER PLANTS IN 128 AQCRs FOR EVALUATION OF IMPACT ON AMBIENT SO2 CONCENTRATIONS, VOLUME 2 Final Report
R. C. Koch Jun. 1975 68 p refs
(Contract EPA-68-02-1483)
(PB-246082/2; GEOMET-EF-486-Vol-2) Avail: NTIS HC $4.50 CSCL 13B

Estimated is the probable impact on annual and 24 hour SO2 concentrations for 1972 operations at the remaining large power plants in U.S.A. The analyses are described that cover 206 power plants in 68 air quality control regions. Also included is the fuel consumption of these plants for 1972. GRA

N76-21759# Olson Labs., Inc., Anaheim, Calif.
GUIDELINES FOR QUALITY ASSURANCE PROGRAMS FOR MOBILE SOURCE EMISSIONS MEASUREMENT SYSTEMS. PHASE 1: LIGHT-DUTY GASOLINE-POWERED VEHICLES QUALITY ASSURANCE GUIDELINES Final Report
Rod Pilkington, Tom Kelly, and Harold Wimette Jun. 1975 316 p refs
(Contract EPA-68-02-1740)
(PB-245787/7; EPA-650/4-75-024-a) Avail: NTIS HC $9.75 CSCL 13F

Quality assurance guidelines for light duty gasoline-powered mobile source emissions measurement systems are presented with the concept of a total quality assurance system. The guidelines apply to quality assurance principles and techniques in the areas of procurement, standards and calibration, test quality control, data validation and corrective action. Model quality management procedures are presented to describe the relationships and responsibilities of the various organizational elements in accomplishing the quality functions. GRA

N76-21760# Olson Labs., Inc., Anaheim, Calif.
GUIDELINES FOR QUALITY ASSURANCE PROGRAMS FOR MOBILE SOURCE EMISSIONS MEASUREMENT SYSTEMS. PHASE 1: LIGHT-DUTY GASOLINE-POWERED VEHICLES TEST PROCEDURES Final Report
Rod Pilkington, Tom Kelly, and Harold Wimette Jun. 1975 275 p
(Contract EPA-68-02-1740)
(PB-245788/5; EPA-650/4-75-024-b) Avail: NTIS HC $9.00 CSCL 13F

Test procedures for light duty gasoline powered mobile source emissions measurement systems are presented with the concept of a total quality assurance system. The test procedures are presented in document control format and give the detailed test procedures with quality assurance provisions for each part of the total testing system. GRA

N76-21761# PEDCO-Environmental Specialists, Inc., Cincinnati, Ohio.
SURVEY OF FLUE GAS DESULFURIZATION SYSTEMS, PADDY'S RUN STATION, LOUISVILLE GAS AND ELECTRIC Final Report
Gerald A. Isaacs Aug. 1975 47 p
(Contract EPA-68-02-1321)
(PB-246136/6; EPA-650/2-75-057-d) Avail: NTIS HC $4.00 CSCL 07A

Results of a survey of the flue gas desulfurization (FGD) system on Unit 6 of Louisville Gas and Electric Co.'s Paddy's Run Power Station are presented. The closed-loop system, uses a slurry of carbide lime in a marble-bed scrubber. The carbide lime, a waste by-product from acetylene manufacturing plant, contains 90-92 percent calcium hydroxide, 2-2.5 percent silica, 3-8 percent calcium carbonate, and 0.1 percent magnesium oxide. Sludge is stabilized by mixing thickener overflow with carbide lime before vacuum filtration. The sludge, containing about 40 percent solids, is trucked to a nearby 10-acre borrow pit, used as a landfill area. The Paddy's Run Station is used primarily to meet summer peaking loads. Boiler No. 6 is operated infrequently because of its low thermal efficiency (heat rate is about 13,000 Btu/kWhr). GRA

N76-21762# Midwest Research Inst., Kansas City, Mo.
COLLABORATIVE TEST OF THE CHEMILUMINESCENT METHOD FOR MEASUREMENT OF NO2 IN AMBIENT AIR
Paul G. Constant, Jr., Michael C. Sharp, and George W. Scheil Feb. 1975 126 p refs
(Contract EPA-68-02-1363)
(PB-246843/7; EPA-650/4-75-013) Avail: NTIS HC $6.00 CSCL 14B

The precision and bias of the method is determined. The NO2, ambient-air sampling system, test sites, selection of collaborators, statistical design' collaborators, field sampling, statistical analysis of collaborators' results, conclusions and recommendations are discussed. Author

N76-21763# Enviro Control, Inc., Rockville, Md.
STUDY OF FEDERAL WATER QUALITY PLANNING EFFICIENCY Final Report
A. Hershaft 15 Mar. 1975 211 p refs Sponsored by Council on Environ. Quality.
(PB-246718/1; EQ-4AC0142) Avail: NTIS HC $7.75 CSCL 13B

Federally supported water quality planning activities, problem areas, and specific ways and means of improving their effectiveness and efficiency are examined. Some areas of interest include: state interstate, and local water quality planning activites that are not federally funded; federal planning activities undertaken to fulfill objectives other than those of PL 92-500; and personnel and research and development programs. GRA

N76-21764# Naval Surface Weapons Center, White Oak, Md.
REMOVAL OF TETRANITROMETHANE FROM AIR STREAMS Final Report
William H. Gilligan and Thomas N. Hall 8 Oct. 1975 28 p
(NSWC Proj. 1272/L01-23)
(AD-A017652; NSWC/WOL/TR-75-128) Avail: NTIS CSCL 13/2

During the manufacture of TNT, one of the side products formed in relatively small amount is tetranitromethane (TNM). In the past it has been the practice to vent the TNM along with some nitrogen oxides (mainly NO) to the atmosphere. However, because of present-day awareness of pollution problems, EPA regulations now require the combined NO/TNM present in the exhaust gases to be below 100 ppm. In order to meet this requirement most of the TNM must be removed. Since TNM as a precursor of nitroform, can be used for the synthesis of a wide variety of polynitroaliphatics a desirable solution would be to collect the TNM as such or as nitroform thereby reducing the cost of pollution abatement. GRA

N76-21765# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CATALYTIC PURIFICATION OF GASEOUS FACTORY EFFLUENTS TO PROTECT THE ENVIRONMENT
A. Balogh, J. Herendi, and J. Bathory 28 Apr. 1975 20 p Transl. into ENGLISH from Magyar Kemikusok Lapja (Hungary), vol. 28, no. 11, 1973 p 566-571
(AD-A017807; FTD-HC-23-1184-75) Avail: NTIS CSCL 13/2

The Hungarian Research Institute for Petroleum and Natural Gas has investigated air pollution control by catalytic oxidation. They have developed an oxide catalyst which can be manufactured from domestic raw materials. A pilot plant was built to study hydrocarbon pollution control by this method. GRA

N76-21766# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALYSIS OF THE DAILY VARIATION OF AIR POLLUTION
O. V. Lomaya and D. G. Tsintsadze 2 Apr. 1975 12 p refs Transl. into ENGLISH from Soobshch. Akad. Nauk Gruz. (Tiflis), vol. 73, no. 2, 1974 p 329-332
(AD-A017806; FTD-HT-23-1172-75) Avail: NTIS CSCL 13/2

The daily variation of the concentrations of solid aerosols was studied from systematic round-the-clock observations in the surface layer of the atmosphere of Tbilisi. GRA

N76-21767# Naval Postgraduate School, Monterey, Calif.
MODIFICATION OF AN AMBIENT AIR QUALITY MODEL FOR ASSESSMENT OF US NAVAL AVIATION EMITTANTS Interim Report
Keith Irving Weal and David W. Netzer Aug. 1975 63 p refs
(AD-A017857; NPS-57NT75071A) Avail: NTIS CSCL 13/2

Two programs which form part of a generalized air quality assessment model for USAF operations were obtained and analyzed. Areas of incompatibility with USN aircraft operations were identified and modified to closely approximate these operations. Data were obtained by observation of operations at a Naval Air Station and these data used to execute the modified programs. These results and the program modifications are discussed. GRA

N76-21768# Life Systems, Inc., Cleveland, Ohio.
RESEARCH AND DEVELOPMENT OF AN ELECTROCHEMICAL BIOCIDE Final Report, Jul. 1974 - Nov. 1975
G. G. See, C. A. Bodo, and K. K. Kacholia Oct. 1975 117 p refs
(Contract DAMD17-74-C-4102)
(AD-A018176; LSI-ER-221-5) Avail: NTIS CSCL 13/2

The development and preliminary characterization of an electrolytic technique for destruction of microorganisms in potable and waste water were successfully completed. The technique employs low level cyclic voltages at chemically inert electrodes to pass an alternating current through the process water. The program was directed toward (a) expanding the design of the electrochemical biocide reactor, (b) determining the engineering parameters which affect process effectiveness and efficiency and establishing hypotheses for the microorganism kill mechanism(s), and (c) preparing recommendations for scaling the process to both United States Army Medical Research and Development Command (USAMRDC) and the National Aeronautics and Space Administration (NASA) requirements. The report describes the experimental hardware, the methodology and microorganism kill results with three bacteria: (Escherichia coli, Pseudomonas aeruginosa and Klebsiella pneumoniae), two viruses (Polio I and Coxsacki B), one yeast (Saccharomyces cerevisiae), and the normal flora of microorganisms found in domestic raw settled sewage. A literature search was conducted on prior research and development efforts related to the electrolytic disinfection of water and waste water. GRA

N76-21769# Texas Univ., Galveston. Marine Biomedical Inst.
EFFECTS OF CRUDE OIL ON MARINE INVERTEBRATES Final Report
James S. Kittredge 26 Aug. 1975 7 p refs
(Contract N00014-68-A-0105-0007; NR Proj. 205-096)
(AD-A017921) Avail: NTIS CSCL 08/1

Laboratory studies indicate that the aliphatic hydrocarbon compounds are not harmful to adult crabs. The monoaromatic hydrocarbons can inhibit behavior that is dependent on chemoreception, but the effect is transient. The polyaromatic hydrocarbon compounds are the potentially dangerous component of oil pollution. Since crustacea and many other species of marine organisms depend on chemoreception not only for locating food sources, but also for detecting predators, finding sexual partners and for locating a suitable niche, inhibition of chemoreception by sublethal amounts of hydrocarbon pollution may drastically limit the productivity of a marine habitat. GRA

N76-21770# Mitre Corp., McLean, Va.
SULFATES AND THE ENVIRONMENT: A REVIEW
Richard S. Greeley, Robert P. Ouellette, John T. Stone, and Sandra Wilcox Mar. 1975 155 p refs
(PB-248122/4; MTR-6895) Avail: NTIS HC $6.75 CSCL 13B

The origin and amounts of sulfates in the atmosphere are considered in terms of the effects of sulfates on human health, animals, and vegetation. Measurement techniques are discussed along with control technology. Economic factors are included. GRA

N76-21771# Stanford Univ., Calif. Dept. of Civil Engineering.
HEAT TREATMENT OF REFUSE FOR INCREASING ANAEROBIC BIODEGRADABILITY Semiannual Progress Report, 1 Jan. - 30 Jun. 1975
James M. Gossett, Joseph B. Healy, Jr., Lilly Y. Young, and Perry L. McCarty 31 Jul. 1975 118 p refs
(Grant NSF GI-43504)
(PB-246158/0; SU-CE-TR-198;
NSF/RANN/SE/GI-43504/PR-75-2; NSF/RA/N-75-089) Avail: NTIS HC $5.50

Heat treatment procedures for converting refractory organic materials to biodegradable substances so they will be convertible to methane gas were studied. Organic refuse materials were subjected to temperatures from 25 to 250C, pH from 1 to 13, and for times up to 3 hours. Biodegradability was assessed with a Warburg respirometer. Optimum temperature for improvement of biodegradability increased with increase in pH from 130C at pH 1 to 200C at pH 13. Increased solubilization of organics was achieved with increased temperature at all pHs, the maximum observed being 90% at pH 13 and 250C. A model of a total heat treatment system suggests various trade-offs for different systems; a predicted 36% increase in methane, 31% reduction in solids for disposal, and 54% reduction in digester volume resulted with heat treatment at pH 13 and 200C. Other studies indicate several ring structures believed formed from heat treatment of refuse are biodegradable. GRA

N76-21772# Science Applications, Inc., La Jolla, Calif.
APPLICATION OF REMOTE MONITORING TECHNIQUES IN AIR ENFORCEMENT
C. B. Ludwig and M. Griggs Apr. 1975 180 p refs
(Contract EPA-68-03-2137)
(PB-247771/9; SAI-75-638-LJ; EPA-340/1-75-009) Avail: NTIS HC $7.50 CSCL 14B

The usefulness of remote sensing techniques for routine field used by enforcement agencies are discussed taking into account the need for laser systems to comply with eye safety regulations. This study confirms that the technique of differential absorption has the best sensitivity for the single-ended measurement of gaseous pollutants. Data interpretation problems of the passive techniques make them less accurate in general, than the active methods. The legal aspects of enforcement monitoring are also investigated. GRA

N76-21773# Battelle Columbus Labs., Ohio.
SO2 REDUCTION IN NON-UTILITY COMBUSTION SOURCES: TECHNICAL AND ECONOMIC COMPARISON OF ALTERNATIVES Final Task Report, May 1974 - Sep. 1975
P. S. K. Choi, E. L. Kropp, W. E. Ballantyne, M. Y. Anastas, and A. A. Putnam Oct. 1975 316 p refs
(Contract EPA-68-02-1323)
(PB-248051/5; EPA-600/2-75-073) Avail: NTIS HC $9.75 CSCL 07A

Technical and economic comparisons of various SO2 control alternatives were made for the important size classes and fuel types. Categories of alternatives included are: physical cleaning of coal, coal gasification, coal liquefaction, fluidized-bed combustion of coal, and flue gas desulfurization. For small size classes of NUC sources, applicabilities of package sorption systems are reviewed. GRA

N76-21774# Illinois Univ., Urbana. Center for Advanced Computation.
FLUE GAS DESULFURIZATION AND LOW BTU GASIFICATION: A COMPARISON, APPENDIX G Final Report
Michael Rieber, Shao Lee Soo, and James Stukel May 1975 106 p refs
(Grant NSF GI-35821)
(PB-248064/8; CAC-163-App-G; NSF/RA/N-75-037G) Avail: NTIS HC $5.50 CSCL 07A

The most abundant high sulfur fuel available in the continental United States is coal. In the intervening five years a great deal was written and said concerning ways to use high sulfur coal. During these five years the utilization of stack gas scrubbers for removing SO2, the primary pollutant involved when high sulfur content coal is burned, was considered the primary option open to potential users of high sulfur coal. Recently, low and medium Btu gasification systems were proposed as another option for utilization of high sulfur fuels. Sulfur dioxide removal processes are described in terms of how the waste products are handled. GRA

N76-21775# Bureau of Mines, Spokane, Wash. Mining Research Center.

ELECTROKINETIC DENSIFICATION OF HYDRAULIC BACKFILL, A FIELD TEST

R. H. Sprute and D. J. Kelsh 1975 25 p refs

(PB-247224/9; BM-RI-8075) Avail: NTIS HC $3.50 CSCL 08I

Hydraulic backfill consisting of siliceous mill tailings was successfully dewatered and consolidated by electrokinetics in a field test conducted at the Star mine, Burke, Idaho. Work was planned and performed by the Bureau of Mines, with the assistance of Hecla Mining Company personnel and management. A stope at the 2,000-foot level was filled in such a way that slimes as well as coarse sand were retained in the stope. Following settlement of solids and decant of surface water, direct current applied between buried electrodes created a firm, dense material in approximately three hours. This rapid densification of fine-grained material demonstrated the utility of this method and suggests other applications, particularly in the control of slime deposits that cause serious problems in many deep mines. These wastes can be converted to competent support material. GRA

N76-21776# California Univ., Davis. Water Resources Center.

REMOVAL OF ORGANIC CARBON FROM WATER BY OXIDATION WITH SOLID CATALYSTS

J. M. Smith Nov. 1975 9 p

(PB-248182/8; UCAL-WRC-W-392; W76-02364; OWRT-A-051-CAL-2) Avail: NTIS HC $3.50 CSCL 07D

The feasibility of liquid phase oxidation of soluble organics in waste water using solid catalysts was investigated. The kinetics of catalytic oxidation under conditions where the intrinsic activity of the catalyst could be established were first evaluated. The kinetics of two promising catalysts were measured. Different types of reactors for practical use in removing organic pollutants from water were then evaluated. Trickle bed reactors appear to be one of the most desirable reactors. A variety of organic pollutants, including refractory acids, can be completely oxidized to carbon dioxide at temperatures of the order of 270 C. Maintaining the water in the liquid phase, which requires compressing the liquid to prevent vaporization, eliminates the energy requirements that would be associated with vaporizing the water. GRA

N76-21777# North Dakota Water Resources Research Inst., Fargo.

THE MICRODETERMINATION OF MERCURY SPECIES IN NATURAL WATER SYSTEMS BY LIQUID CHROMATOGRAPHY

Richard J. Baltisberger Jan. 1975 62 p refs

(Contract DI-14-31-0001-3922)

(PB-248079/6; W1-222-010-75; OWRT-B-020-NOAK-2) Avail: NTIS HC $4.50 CSCL 07D

Mercury in environmental water samples can exist in several cationic forms such as Hg(2+), Hg2(2+) and CH3Hg(+). Two analytical techniques were developed and tested for (1) the measurement and differentiation of inorganic and organic mercury cations in environmental samples and (2) the separation by ion exchange, chromatographic means of these cations and their ultimate analysis by flameless atomic spectrophotometry. The first method is useful in the concentration range from 0.1 to 10 ppb Hg2(2+), Hg(2+) or CH3Hg(+). The latter method is useful from 1 to 10 ppb mercury. GRA

N76-21778# Energy Resources Co., Inc., Cambridge, Mass.

A REVIEW OF CONCENTRATION TECHNIQUES FOR TRACE CHEMICALS IN THE ENVIRONMENT Interim Report, Jul. 1974 - Feb. 1975

Nov. 1975 489 p refs

(Contract EPA-68-01-2925)

(PB-247946/7; EPA-560/7-75-002) Avail: NTIS HC $12.50 CSCL 07D

This report contains a discussion of the techniques which are currently available for the concentration of trace pollutants prior to their analysis. Methods for the accumulation of metals and organic compounds from air, water, and solids are covered as well as a review of recent literature on bioaccumulation. Each section includes tables in which concentration methods, and the accumulated materials are listed along with the pertinent literature references. GRA

N76-21779# Wisconsin Univ., Madison. Dept. of Entomology.

PESTICIDE DEGRADATION BY MARINE ALGAE Final Report

G. Boush and F. Matsumura 1 Apr. 1976 23 p refs

(Contract N00014-67-A-0128-0023; NR Proj. 306-061)

(AD-A008275) Avail: NTIS CSCL 06/6

Various algae species were tested for their susceptibilities towards chlorinated hydrocarbon insecticides. Dieldrin, which is the most frequently found pesticidal contaminant in the U.S., and its analogs, were found to inhibit the growth of certain algae. Anacystis nidulans in particular showed marked susceptibility to endrin, dieldrin, ketoendrin and photodieldrin. This species was also susceptible towards dieldrin metabolites such as metabolite F and G. Among DDT metabolites DDD TDE was found to be the most toxic material, followed by DDE, DDI and FW-152. It has not been known that DDT should be more toxic to algae. In terms of acute toxicity phenylmercuric acetate was by far the most algicidal agent among all pesticidal chemicals tested. This pesticide is toxic to both A. nidulans and A. quadruplicatum at the concentration of 1 ppb. GRA

N76-21780# A. P. T., Inc., San Diego, Calif.

ENTRAINMENT SEPARATORS FOR SCRUBBERS Final Report

Seymour Calvert, Shuichow Yung, and James Leung Aug. 1975 219 p refs

(Contract EPA-68-02-0637)

(PB-248050/7; EPA-650/2-74-119-b) Avail: NTIS HC $7.75 CSCL 07A

The use of entrainment separation to remove the liquid mist carried out of a scrubber by the effluent gas is studied. Included are an evaluation of current technology, results of experimental studies of entrainment separator characteristics, and theoretical analyses. Zig-zag baffle, knitted mesh, tube bank, packed bed, and cyclone devices were tested. Collection efficiency and reentrainment were measured and related to drop size and separator geometry. Pressure drop as a function of gas flow rate is also reported. The effects of suspended solids on collection efficiency and the nature and extent of solids deposition were also investigated. GRA

N76-21781# Environmental Research Lab., Narragansett, R.I.

ANNOTATED BIBLIOGRAPHY ON BIOLOGICAL EFFECTS OF METALS IN AQUATIC ENVIRONMENTS

Ronald Eisler and Maryjane Wapner Oct. 1975 406 p

(PB-248211/5; EPA-600/3-75-008) Avail: NTIS HC $11.00 CSCL 06T

A total of 725 references are listed on the toxicological, physiological, and metabolic influence of stable and radiolabelled chemical species of metal cations to marine, estuarine, and freshwater fauna and flora. References were annotated and subsequently indexed by metal, by taxa, and by author, in cumulative indices which encompass this volume and the initial volume in this series. GRA

N76-21782# Municipal Environmental Research Lab., Cincinnati, Ohio. Wastewater Research Div.

THE IMPACT OF PUBLIC LAW 92-500 ON MUNICIPLE POLLUTION CONTROL TECHNOLOGY Interim Report

Benjamin W. Lykins, Jr. and John M. Smith Jan. 1976 320 p refs

(PB-248212/3; EPA-600/2-76-018) Avail: NTIS HC $9.75 CSCL 13B

Examined is the impact of water quality law on the effluent quality discharged from publicly owned waste water treatment plants and the adequacy of existing technology to meet these requirements is assessed. The report also identifies effluent standards that are more stringent than the national minimum requirement for secondary treatment. A comparison of existing technology with projected needs indicates that some form of technology is available to achieve the required removal of suspended solids nitrogen and phosphorus. However, development and demonstration of additional technology are needed to reduce

BOD concentrations to the required limits and to provide alternate disinfection processes. GRA

N76-21783# Environmental Sciences Research Lab., Research Triangle Park, N.C.
REPORT ON THE PROBLEM OF HALOGENATED AIR POLLUTANTS AND STRATOSPHERIC OZONE Final Report
Dec. 1975 65 p refs Submitted to the Committee on Interstate and Foreign Commerce, (US House)
(PB-247699/2; EPA-600/9-75-008) Avail: NTIS HC $4.50 CSCL 13B

Principal compounds under study are fluorocarbon-11, fluorocarbon-12, fluorocarbon-22, carbon tetrachloride, methyl chloroform, perchloroethylene, trichloroethylene, dichloroethane, methylene dichloride, and methyl chloride. Laboratory studies concern the rates of decomposition of these pollutants in the air and the identity and fate of their decomposition products. Field studies involve measuring concentrations of halocarbons and their decomposition products as functions of altitude and distance from sources. Fluorocarbons are discussed, with regard to emission sources, current control technology, and possible chemical substitutes. GRA

N76-21784# Battelle Columbus Labs., Ohio.
EVALUATION OF NATIONAL BOILER INVENTORY Final Report, 14 Apr. - 10 Oct. 1975
A. A. Putnam, E. L. Kropp, and R. E. Barrett Oct. 1975 72 p refs
(Contract EPA-68-02-1223)
(PB-248100/0; EPA-600/2-75-067) Avail: NTIS HC $4.50 CSCL 13A

Residential, commercial, industrial, and utility boilers are included. Results are presented as: Cumulative boiler installed capacity and cumulative actual boiler use (by fuel and total), both plotted against boiler size; cumulative SO2, NOx, and particulate emissions (by fuel and total), plotted against boiler size; and tables of boiler number count, boiler installed capacity, boiler actual use, SO2 emission, NOx emission, and particulate emission, by boiler size and fuel. GRA

N76-21785# Massachusetts Univ., Amherst. Water Resources Research Center.
TRITIUM AND DEUTERIUM AS WATER TRACERS IN HYDROLOGIC SYSTEMS Completion Report
Gordon L. Stewart and John R. Stetson May 1975 48 p refs
(Contract DI-14-31-001-4021)
(PB-248408/7; Completion-FY-76-2; PUB-55; W76-02870; OWRT-A-045-MASS(2)) Avail: NTIS HC $4.00 CSCL 13B

This study involved studying the interaction of tracers with soil materials and evaluating this interaction in terms of retardation in tracer flow velocity, compared to bulk water flow. The data presented clearly show that a tracing front becomes diluted in tracer during infiltration into oven-dried soil. There appears to be very little difference between the degree of tritium and deuterium interaction. The source of interaction is demonstrated to be primarily hydroxyl associated with the clay minerals. These exchange sites are destroyed by heating soil to 70C which eliminates tracer loss during infiltration. GRA

N76-21786# North Carolina Water Resources Research Inst., Raleigh.
WATER SUPPLY AND WASTEWATER IN COASTAL AREAS
James M. Stewart 1975 194 p refs Reprinted Proc. of Southeastern Conf. held 2-4 Apr. 1975 Sponsored in part by Coastal Plains Center for Marine Develop. Serv., Washington, D. C. and NOAA
(PB-248297/4; NOAA-75120106; Rept-83) Avail: NTIS HC $7.50 CSCL 13B

The article details the proceedings of the southeastern conference on Water Supply and Wastewater in Coastal Areas. The conference was conducted to review the state of the art of proper planning and management of water supply and wastewater disposal in coastal areas. Special attention was paid to defining technological and institutional alternatives, their relation to land use planning and environmental protection and to identifying those water and wastewater problems of significance in coastal areas. A major problem that was discussed at the conference is associated with increasing population growth and economic development in these areas is the provision of safe and adequate water supplies and management of wastewater discharges in a manner consistent with public health and welfare and environmental protection. Both the presentations and discussion sessions are included in the report. GRA

N76-21787# IIT Research Inst., Chicago, Ill.
ABSTRACTS OF THE 1971 - 1974 UNITED STATES AND FOREIGN OPEN LITERATURE ON NOISE, PART 2
E. P. Bergmann and I. B. Fieldhouse Jan. 1976 484 p refs
(Contract EPA-68-01-2234)
(PB-248293/3; IITRI-J6331-Pt-2; EPA-600/2-76-016-b) Avail: NTIS HC $12.50 CSCL 13B

This document is a task report of effort directed toward a search of the open literature to provide some insight into the noise reduction effort outside of the Federal Government and in foreign countries. A compilation of the abstracts is presented as an appendix. GRA

N76-21788# State Univ. of New York, Albany.
TRAVELS OF AIRBORNE POLLEN Final Report, 1 Oct. 1970 - 31 Dec. 1974
Jan. 1975 109 p refs
(Grant EPA-800677)
(PB-247700/8; EPA-650/3-75-003) Avail: NTIS HC $5.50 CSCL 13B

The following studies were conducted on the transport and dispersion of airborne pollen: (a) development and evaluation of sampling devices for pollen; (b) development and evaluation techniques for tagging pollen in living plants with dyes and radioisotopes; (c) dispersion and deposition of pollen from known sources of various configurations; (d) effects of forested areas on the removal of pollen from the atmosphere; (e) concentration variations of pollen, natural sources with distance, height, time and other variables; (f) feasibility of predicting ragweed pollen concentrations, unknown sources. GRA

N76-21789# Research Triangle Inst., Research Triangle Park, N.C.
EFFECTS OF TRANSIENT OPERATING CONDITIONS ON STEAM-ELECTRIC GENERATOR EMISSIONS Final Report, Jan. 1974 - Jan. 1975
J. S. McKnight Aug. 1975 113 p refs
(Contract EPA-68-02-1325)
(PB-247701/6; EPA-600/2-75-022) Avail: NTIS HC $5.50 CSCL 13B

The report reviews the effects of transient operating conditions on gaseous emissions from fossil-fuel-fired steam-electric generating plants. Emissions of concern are nitrogen oxides, sulfur oxides, particulates, and visible emissions. Particular attention is given to older coal-fired generators used to provide the cycling portion of the diurnal variation in electricity generated by electric utilities. No consideration is given to flue gas desulfurization processes used to remove sulfur oxides. Transient conditions included in this study are starts, stops, cycling, and upset conditions caused by equipment malfunctions or changes in fuel characteristics or load. GRA

N76-21790# Battelle Columbus Labs., Ohio.
EVALUATION OF THREE OF THE BIOME STUDIES PROGRAMS FUNDED UNDER THE FOUNDATION'S INTERNATIONAL BIOLOGICAL PROGRAM (IBP) Final Report, Jul. 1974 - Nov. 1975
Kenneth M. Duke, Samuel Globe, William E. Martin, Ramona A. Mayer, and John T. McGinnis 12 Nov. 1975 332 p refs
(Contract NSF C-879)
(PB-248180/2) Avail: NTIS HC $10.00 CSCL 06F

Contributions of integrated research programs made to the science of ecology are considered. Battelle developed methodologies for evaluating the open literature and other contributions, the role of management, and the influence of these programs on the participating scientists. Findings indicate that the three biome programs have produced a body of literature with better balance and depth at greater cost than other smaller scale integrated research projects. GRA

N76-21791# Air Products and Chemicals, Inc., Marcus Hook, Pa. Houdry Div.
ENGINEERING AND COST STUDY OF AIR POLLUTION CONTROL FOR THE PETROCHEMICAL INDUSTRY. VOLUME 9: POLYVINYL CHLORIDE MANUFACTURE Final Report
R. G. Bellamy and W. A. Schwartz Jul. 1975 111 p refs
(Contract EPA-68-02-0255)
(PB-247705/7; EPA-450/3-73-006-i-Vol-1) Avail: NTIS HC $5.50 CSCL 07A

A total of nine petrochemicals produced by twelve distinctly different processes were selected. Ten volumes, entitled Engineering and Cost Study of Air Pollution Control for the Petrochemical Industry were prepared. A combination of expert knowledge and an industry survey was used to select these processes. This volume covers the manufacture of polyvinyl chloride. Included is a process and industry description, an engineering description of available emission control systems, and the cost of these systems. GRA

N76-21792# National Environmental Research Center, Athens, Ga. Environmental Research Lab.
ANALYSIS OF ORGANIC COMPOUNDS IN TWO KRAFT MILL WASTEWATERS Final Report
Lawrence H. Keith Jun. 1975 112 p refs
(PB-247698/4; EPA-660/4-75-005) Avail: NTIS HC $5.50 CSCL 07D

Wastewaters from two kraft paper mills in Georgia were sampled at various points in the waste treatment systems. Gas chromatography of the organic extracts and identification of many of the specific chemical components by gas chromatography-mass spectrometry provided a 'chemical profile' of the effluents. The mills, in different geographical locations, have very similar raw wastewater compositions but different wastewater treatments. In spite of these differences, the treated effluents are qualitatively similar in composition although the quantities of the various components differ. After two years the raw and treated effluents of both mills were re-sampled. Analyses showed that although concentrations of the organics varied, the same compounds are still present. GRA

N76-21793# Dow Chemical Co., Freeport, Tex.
OPTIMIZING A PETROCHEMICAL WASTE BIO-OXIDATION SYSTEM THROUGH AUTOMATION Final Report, 1973 - 1974
M. A. Zeitoun, W. F. McIlhenny, N. J. Biscan, J. H. Culp, and H. C. Behrens Jun. 1975 214 p
(Contract EPA-S-800766)
(PB-247160/5; EPA-660/2-75-021) Avail: NTIS HC $7.75 CSCL 07A

Systems were developed to control the critical parameters of the activated sludge process to achieve reliable, high quality effluent. The waste water from a petrochemical plant contained ethylene glycol and was sometimes saline. An automated sampling system, sampling feed, and homogenized mixed liquor, monitored the total carbon in both samples. Nutrients were added in proportion to the total carbon in the feed, thus maintaining low residual nutrients in the effluent. The sludge recycle flow rate was controlled by a food to microorganisms signal, measured as the ratio of total carbon in the feed to that in the mixed liquor. GRA

N76-21794# National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program Office.
RESEARCH RESULTS FOR FISCAL YEAR 1974: MESA NEW YORK BIGHT PROJECT
Sep. 1975 198 p refs
(PB-247926/9; NOAA-TM-ERL-MESA-2; NOAA-75111702) Avail: NTIS HC $7.50 CSCL 08J

It summarizes the scientific technical and engineering accomplishments of the project during fiscal year 1974 (FY74), the last quarter of FY73, not summarized previously. Research results are presented in a classical discipline orientation for physical, chemical, biological, and geological research efforts. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N76-21795*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Sciences Lab.
STUDY OF PLASMASPHERE DYNAMICS USING INCOHERENT SCATTER DATA FROM CHATANIKA, ALASKA RADAR FACILITY Final Report
Edward G. Shelley 7 Nov. 1975 34 p refs
(Contract NASw-2582)
(NASA-CR-146800; LMSC-D462625) Avail: NTIS HC $4.00 CSCL 04A

Results of the study of Chatanika incoherent scatter radar data and Lockheed Palo Alto Research Laboratory satellite data are reported. Specific topics covered include: determination of the effective recombination coefficient in the auroral E region; determination of the location of the auroral oval; auroral boundary characteristics; and the relationship of auroral current systems, particle precipitation, visual aurora, and radar aurora. J.M.S.

N76-21796*# Kanner (Leo) Associates, Redwood City, Calif.
SOME NOTES ON ATMOSPHERIC OZONE
M. Nicolet Washington pub NASA Apr. 1976 13 p refs Transl. into ENGLISH from Inst. Roy. Meteorol. de Belgique, Publ., Ser. a (Belgium), no. 91, 1975 p 33-38
(Contract NASw-2790)
(NASA-TT-F-17000) Avail: NTIS HC $3.50 CSCL 04A

A brief review of the principal reactions playing a role in the formation and destruction of stratospheric ozone is given. The action of hydroxyl and hydroperoxyl radicals produced by H2O, CH4 and H2 disocciation is indicated. Nitric oxide produced by oxidation of nitrous oxide or by generation of nitrogen atoms by cosmic rays leads to nitrogen oxide molecules. Finally, freons or other constituents such as CC14 lead to chlorine atoms which destroy ozone. Author

N76-21797*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA GLOBAL ATMOSPHERIC SAMPLING PROGRAM (GASP). DATA REPORT FOR TAPE VL0001
J. D. Holdeman and E. A. Lezberg Mar. 1976 25 p refs
(NASA-TM-X-71905; E-8694) Avail: NTIS HC $3.50 CSCL 04A

Atmospheric trace constituents in the upper troposphere and lower stratosphere are now being measured as part of the NASA Global Atmospheric Sampling Program (GASP), using fully automated air sampling systems on board commercial 747 aircraft in routine airline service. Measurements of atmospheric ozone and related meteorological and flight information obtained during several GASP flights in March 1975 are now available from the National Climatic Center, Asheville, North Carolina. In addition to the data from the aircraft, tropopause pressure data obtained from the National Meteorological Center (NMC) archives for the dates of the flights are included. This report is the first of a series of reports which describes the data currently available from GASP, including flight routes and dates, instrumentation, the data processing procedure used, and data tape specifications. Author

N76-21798*# Transemantics, Inc., Washington, D.C.
DETERMINATION OF THE MOISTURE CONTENT OF THE ATMOSPHERE OVER DRYLAND SURFACE
Yu. I. Rabinovich and G. G. Shchukin NASA Mar. 1976 19 p refs Transl. into ENGLISH from Eksperim., Tr. no. 309, Gidrometeoizdat (Leningrad), 1975 p 3-14
(Contract NASw-2972)
(NASA-TT-F-16926) Avail: NTIS HC $3.50 CSCL 04A

The possibility of measuring the integral content of water vapor in the atmosphere, as well as the water content of clouds and precipitation according to eigen thermal radio emission in the centimeter wavelength over different types of underlying surfaces from aircraft is examined. The results of calculations of the transfer of microwave emission over a dryland surface for

different atmospheric models are given. The possibility of detecting precipitation through a cloud on the basis of experimental investigations at a wavelength of lambda = 3.2 cm. is indicated. Author

N76-21799*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
ASTROGEODETIC GEOID OF JAPAN
Yasuhiro Ganeko 1 Mar. 1976 38 p refs
(Grant NGR-09-015-002)
(NASA-CR-146855; SAO-Special-Rept-372) Avail: NTIS HC $4.00 CSCL 08E

Three kinds of astrogeodetic geoid maps for Japan are presented: one referred to the global (18, 18) geoid of the 1973 Smithsonian Standard Earth (III) (SE III), referred to the best-fitting ellipsoid of SE III, and one referred to the reference ellipsoid of the Tokyo datum. Interpolations of the deflection of the vertical are carried out by a least squares estimation method. The geoid height differences obtained are compared with solutions of satellite-derived station positions. Good agreement is found in a comparison with Doppler tracking stations. Author

N76-21800*# California Inst. of Tech., Pasadena.
THE GENERATION OF GRAVITATIONAL WAVES. 2: THE POST-LINEAR FORMALISM REVISITED
Ronald J. Crowley and Kip S. Thorne [1975] 34 p refs
(Grants NGR-05-002-256; NSF AST-75-01398-A01)
(NASA-CR-14687) Avail: NTIS HC $4.00 CSCL 08N

Two different versions of the Green's function for the scalar wave equation in weakly curved spacetime (one due to DeWitt and DeWitt, the other to Thorne and Kovacs) are compared and contrasted; and their mathematical equivalence is demonstrated. The DeWitt-DeWitt Green's function is used to construct several alternative versions of the Thorne-Kovacs post-linear formalism for gravitational-wave generation. Finally it is shown that, in calculations of gravitational bremsstrahlung radiation, some of our versions of the post-linear formalism allow one to treat the interacting bodies as point masses, while others do not. Author

N76-21801*# Scientific Translation Service, Santa Barbara, Calif.
THE POPIGAY METEORITE CRATER
V. L. Masaytis, M. V. Mikhaylov, and T. V. Selivanovskaya Washington NASA Mar. 1976 171 p refs Transl. into ENGLISH of the book "Popigayskiy Meteoritnyy Krater" Moscow, Nauka Press, 1975 p 1-124
(Contract NASw-2791)
(NASA-TT-F-16900) Avail: NTIS HC $6.75 CSCL 08G

Descriptions of general aspects of the morphology and structure of the Popigay crater, basic characteristics of deformations of the surrounding rock caused by the explosion of the meteorite, and the structure and composition of the breccias and impactites which fill the crater were given; descriptions are given of the impact-metamorphosed rocks and the related specific formations (fans of crumbling, diaplectic minerals and glasses, etc.); basic data are given on the physical properties and petrochemistry of the impactites. Author

N76-21802*# Alaska Univ., College. Geophysical Inst.
COORDINATED ANALYSIS OF VARIOUS AURORAL MEASUREMENTS MADE DURING NASA'S 1968 AND 1969 AIRBORNE AURORAL EXPEDITIONS Final Report, 1 Jan. 1973 - 31 Dec. 1975
G. G. Sivjee Apr. 1976 101 p refs
(Grant NGR-02-001-099)
(NASA-CR-146857) Avail: NTIS HC $5.50 CSCL 04A

Auroral optical measurements made aboard NASA's CV 990 were analyzed. The measurements analyzed form a small part of extensive spectroscopic, photometric and photographic data gathered during the 1968 and 1969 Airborne Auroral Expeditions. Simultaneous particle measurements from ESRO IA satellite were used in the analysis. Information about magnetospheric boundaries, interaction between magnetosheath particles and the terrestrial ionosphere, the polar bulge in helium abundance and excitation mechanisms of the triplet state of atmospheric N2 in auroras was obtained. Further analysis of the data is required to elucidate the relation between 3466 and 5200 A emissions of NI and the excitation of 3726-3729 A emissions from atomic oxygen ions in auroras. Author

N76-21803# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE ROLE OF THE FOUNTAIN EFFECT IN THE EQUATORIAL IONOSPHERE IN THE PROLONGED CONSERVATION OF RADIOACTIVE PRODUCTS OF THE EXPLOSION SEA STAR AT F-REGION
A. D. Boliunova [1975] 9 p refs Transl. into ENGLISH from Kosm. Issled. (USSR), v. 13, no. 5, 1975 p 723-729
Avail: NTIS HC $3.50; National Translations Center, John Crerar Library, Chicago, Illinois 60616

The effect of prolonged holding of radioactive products (fission fragments) detected by the Cosmos-3, Cosmos-5 and Cosmos-6 after the Sea Star thermonuclear explosion at F -region altitudes of the low and middle latitude ionosphere was analyzed from the viewpoint of ion transport process representations in the near-equatorial ionosphere. A qualitative explanation of this phenomenon on the basis of the fountain effect in the equatorial ionosphere is proposed which satisfactorily agrees with experiment. Author

N76-21804# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
MID-INFRARED SPECTRAL BEHAVIOR OF SEDIMENTARY ROCKS Environmental Research Papers
Graham R. Hunt and John W. Salisbury 2 Jul. 1975 49 p (AF Proj. 7670)
(AD-A016427; AFCRL-TR-75-0356; AFCRL-ERP-520) Avail: NTIS CSCL 08/7

Mid-infrared (6- to 40-micrometer) spectra of sedimentary rocks and rock-forming minerals are presented. Molecular vibration bands are identified and the causes of spectral scatter among different samples of the same rock type are determined. It is concluded that mid-infrared spectra of sedimentary rocks are an excellent guide to their major mineral content. The chief drawback for terrestrial remote sensing of these rocks is that the major carbonate absorption band lies outside the atmospheric window. Author (GRA)

N76-21805# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
ATMOSPHERIC TRANSMITTANCE AND RADIANCE, METHODS OF CALCULATION
Anthony J. LaRocca Jun. 1975 508 p
(Contracts N00014-74-C-0285; N00014-73-A-0321-0002; NR Proj. 315-001)
(AD-A017459; ERIM-107600-10-T) Avail: NTIS CSCL 04/1

The report is broadly divided into the categories of scattering and absorption, with the greater stress laid on absorption. The first of these is the so-called line-by-line direct integration method, which requires a detailed compilation of the characteristics of individual molecular lines. The second of the absorption methods of calculation presented is the band-model technique. In this method, the line spectrum is approximated by some mathematically manipulatable distribution function with undetermined band-model parameters. By comparison of calculated results with laboratory experimental data the parameters are defined, and the band-model is used for calculating transmittance under any required meteorological conditions. The third general set of techniques is given the heading Multi-Parameter Analytical Procedures. These techniques are derived from the band-model concept, incorporating a larger number of parameters, with presumably greater accuracy in the resultant calculations. The rest of the report is either tutorial or supportive, presenting details of information which is required as input to the calculation procedures. GRA

N76-21806# Helsinki Univ. (Finland). Research Inst. for Theoretical Physics.
GRAVITATIONAL THREE-BODY SCATTERING EXPERIMENT
Mauri J. Valtonen 1975 33 p refs
(HU-TFT-74-31; ISBN-951-45-0498-4) Avail: ERDA Depository Libraries HC $4.75

The gravitational interaction between an equal component circular binary and a third particle of equal mass was studied in detail for nearly parabolic planar orbits. An approximate analytical model for energy transfer was constructed by harmonic analysis. Author (NSA)

N76-21807# Joint Inst. for Nuclear Research, Dubna (USSR).
DYNAMICAL AFFINE SYMMETRY AND COVARIANT PERTURBATION THEORY FOR GRAVITY
V. N. Pervushin 1975 20 p refs
(JINR-E2-8909) Avail: ERDA Depository Libraries HC $4.00

The covariant perturbation theory for gravity with the simplest reduction properties is formulated. The main points are as follows: fundamental fields are the normal coordinates of ten-dimensional space of the gravitational field, and the fields are separated into the classical (background) and quantum ones in the generating functional along geodesics of this space.
Author (NSA)

N76-21808# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
MECHANISMS THAT MAY SUPPORT MAGNETIC-FIELD-ALIGNED ELECTRIC FIELDS IN THE MAGNETOSPHERE
Lars P. Block and Carl-Gunne Faelthammar Sep. 1975 41 p refs Presented at the 16th IUGG Gen. Assembly Submitted for publication
(TRITA-EPP-75-22) Avail: NTIS HC $4.00

The possibility of large magnetic-field-aligned voltage drops in the magnetosphere and upper ionosphere is considered. These may be caused by anomalous resistivity; however, it is pointed out that this is one among several proposed mechanisms and that combinations of them may also be important. Five specific mechanisms are reviewed: differential pitch-angle anisotropy of hot plasma in a magnetic mirror field, thermoelectric effect in the transition region between a hot and a cool plasma, outward electric current draining a substantial part of the plasma sheet random electron current, anomalous resistivity, and electric double layers.
Author (ESA)

N76-21809# Air Force Global Weather Central, Offutt AFB, Nebraska.
THE AFGWC SNOW COVER ANALYSIS MODEL
Saba A. Luces, Samuel J. Hall, and James D. Martens 1 Jun. 1975 27 p refs
(AD-A017942; AFGWC-TM-75-1) Avail: NTIS CSCL 08/12

The report documents the Air Force Global Weather Central (AFGWC) Automated Snow Cover Analysis Model. It describes the data input, analysis procedures, problems, possible improvements and potential uses of the model. The hemispheric model became operational in March 1975. It uses hourly surface synoptic data, meteorological satellite video brightness data and climatological data to determine the depth and age of snow on the ground on a hemispheric grid with a 25 nmi spacing. The resulting daily analyses provide a Northern Hemisphere data base which is stored on high speed computers and available for many meteorological and other scientific applications.
GRA

N76-21810# Illinois Univ., Urbana. Dept. of Civil Engineering.
A TRANSMITTING BOUNDARY FOR FINITE-DIFFERENCE ANALYSIS OF WAVE PROPAGATION IN SOLIDS Civil Engineering Studies
Min Nan Tseng and Arthur R. Robinson Nov. 1975 134 p refs
(Contract N00014-75-C-0164; Grant NSF GK-24294; NR Proj. 064-183)
(AD-A018117; UILU-ENG-75-2024) Avail: NTIS CSCL 08/11

The object of this study is to develop a transmitting boundary suitable for use in numerical solution of wave propagation problems. The detailed analysis refers to two-dimensional problems in plane strain. The medium near the transmitting boundaries must be linear, but inelastic action is permitted within the region. The method consists first of splitting the field near the boundaries into its irrotational (P) and equivoluminal (S) components by finding potentials for the motion near the boundaries. Transmitting boundaries are then developed which pass P and S waves with no interaction. Two types of transmitting boundary have been devised. In the first, the disturbances are taken as locally plane near the boundary in each time interval. A more refined approximation is also obtained in which the disturbances are taken as locally cylindrical. Numerical comparisons have been carried out which indicate that these transmitting boundaries actually perform well and are suitable for practical computation. In addition, other boundary conditions are examined by the use of potentials, especially the boundary between two elastic layers with different properties. Calculations show that the numerical solutions in the vicinity of such a boundary are stable, unlike the results obtained in some earlier work which did not use potentials.
GRA

N76-21811# Illinois Univ., Urbana. Dept. of Civil Engineering.
MOTION ON THE SURFACE OF A LAYERED ELASTIC HALF SPACE PRODUCED BY A BURIED DISLOCATION PULSE
Mirhamid Seyyedian-Choobi and Arthur R. Robinson Nov. 1975 160 p refs
(Contract N00014-75-C-0164; Grant NSF GK-24294; NR Proj. 064-183)
(AD-A018118; UILU-ENG-75-2025; Ser-421) Avail: NTIS CSCL 08/11

In this work solutions are developed for the motions generated in an elastic half space or a half space with a softer layer above it by propagating dislocations on an inclined fault plane. Both dip-slip and strike-slip relative motions have been considered. The dislocations are two-dimensional motions originating in the lower layer. The area over which dislocations are present spreads from a line source as the front of the dislocation propagates on the fault plane. The propagating fault can be stopped suddenly on both sides or on just one side. Surface motions are computed using an extension of the Smirnov-Sobolev method for self-similar solutions. The extension is needed to take care of non-parallel boundaries arising from the inclination of the fault plane to the horizontal. The effect of layering is shown to be important in providing motions at the surface which have the type of 'rebound' that is noted in displacements inferred from strong-motion records of earthquakes. The motions obtained for a single spreading dislocation which suddenly starts and stops is compared with the displacement found from the Pacoima Dam records in the 1971 San Fernando earthquake. The general shape of the motion is seen to correspond well to the results for a single pulse in a layered solid, whereas the case of no layering cannot produce a similar motion.
GRA

N76-21812# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Earth Sciences.
LAKE ERIE INTERNATIONAL JETPORT MODEL FEASIBILITY INVESTIGATION. REPORT 17-5, THE WIND-DRIVEN CURRENTS AND CONTAMINANT DISPERSION IN THE NEAR-SHORE OF LARGE LAKES Ph.D. Thesis
Yea-Yi Peter Sheng Oct. 1975 220 p refs
(Contract DACW39-74-C-0080)
(AD-A017694; WES-CR-H-75-1) Avail: NTIS CSCL 08/8

The wind-driven circulation and dispersion of contaminants in a near-shore region of Lake Erie have been studied by means of numerical models. The first problem studied was that of the thickness of the coastal boundary layer in a large lake. In this study, the non-linear acceleration and Coriolis force terms were included in the equations of motion. Next, a major study of the steadystate and time-dependent currents in the near-shore Cleveland area of Lake Erie, under present conditions and as modified by large man-made structures or islands, e.g., a jetport in the lake, was made. The effects of (1) a jetport island approximately 6 miles offshore of Cleveland, and (2) a land-fill extension of this island to shore, were examined in detail. The island was found not to affect the flow appreciably while the extension to the shore modified the flow significantly. With some modification, the numerical models developed in this report can be applied to study the near-shore regions of other large lakes and the ocean.
GRA

N76-21813# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
RADIOWAVE RESISTIVITY MEASUREMENTS IN NORTHERN MAINE FOR IDENTIFYING BEDROCK TYPE
Paul V. Sellman, Allan J. Delaney, and Pieter Hoekstra Oct. 1975 18 p refs
(AD-A017944; CRREL-SR-238) Avail: NTIS CSCL 08/7

A preliminary ground resistivity survey using the VLF radiowave method was conducted in northern Maine near the site of the proposed Dickey-Lincoln dam and hydroelectric project. This survey was intended to establish if adequate resistivity

contrasts exist between bedrock types in the area to warrant further bedrock distribution studies by airborne resistivity techniques. A more complete understanding of the geology of this area was considered necessary in an attempt to locate rock types suitable for construction purposes near the proposed construction sites. Field observations were made on all types commonly found in the area, including the dominant gray slates and the less common orthoquartzites and granodiorites. The granodiorites are considered most suitable for construction purposes. GRA

N76-21814# Army Engineer Topographic Labs., Fort Belvoir, Va.

SURFACE MATERIALS AND TERRAIN FEATURES OF YUMA PROVING GROUND. PART 1: SUMMARY DESCRIPTION

H. Frank Barnett, Jr. May 1975 18 p refs
(DA Proj. 1T1-62112-A-528)
(AD-A018175; ETL-0021) Avail: NTIS CSCL 08/7

This report summarizes geologic and terrain information pertinent to the conduct of materiel testing at the U.S. Army Yuma Proving Ground. Surface features are described in two categories -- Bedrock Mountains and Alluvial Lowlands. Only the Alluvial Lowlands are extensively and continuously used in testing; they, therefore, are treated in greater detail as differing in grain sizes of materials and relative degrees of surface dissection. The distribution of surficial materials, based on mapping at a scale of 1:62,500, is generalized at a scale of 1:500,000 for this summary. The mapping program and related activities provide a basis for improvement of field environmental testing, particularly in relation to ground-vehicle mobility, surface transportability, and vulnerability to detection. GRA

N76-21815# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

GAS INCLUSIONS IN THE ANTARCTIC ICE SHEET AND THEIR SIGNIFICANCE

Anthony J. Gow and Terrence Williamson Oct. 1975 25 p refs
(AD-A018016; CRREL-RR-339) Avail: NTIS CSCL 08/12

Cores obtained from the bottom of the Antarctic Ice Sheet at Byrd Station were used to analyze the physical properties of air bubbles trapped in the ice. Parameters measured were the sizes, shapes, abundances, spatial distributions, gas volumes and pressure of bubbles, and their variations with depth in the ice sheet. Bubbles occur abundantly in the top 800 m of ice but then gradually disappear until they can no longer be detected optically below 1,100 m. This disappearance is not accompanied by any significant loss of air from the ice and all available evidence indicates that the air actually diffuses into the ice in response to increasing overburden pressure. Bubble pressure measurements show that (1) bubbles with pressures exceeding about 16 bars begin to relax back to this value soon after in situ pressures are relieved by drilling, (2) further slow decompression occurs with time, and (3) the rate of decompression is controlled to some extent by the intrinsic structural properties of the ice and its thermal and deformational history. Only small variations were observed in the entrapped air content of the ice cores; they probably reflect variations in the temperature and/or pressure of the air at the time of its entrapment, but the data are not sufficient to draw any firm conclusions regarding past variations in ice sheet thickness. Only ice from the bottom 4.83 m was found to lack any detectable trace of air. GRA

N76-21816# Army Electronics Command, Fort Monmouth, N.J.

EMPIRICAL INVESTIGATION OF THREE ITERATIVE METHODS FOR INVERTING THE RADIATIVE TRANSFER EQUATION

Elton P. Avara and George Alexander Oct. 1975 32 p refs
(DA Proj. 1T1-62111-AH-71)
(AD-A017730; ECOM-5576) Avail: NTIS CSCL 04/1

Three iterative methods for inverting the integral form of the radiative transfer equation to obtain temperature profiles from satellite infrared radiance measurements were subjected to a detailed empirical investigation. The methods are (a) minimum information method, (b) Smith's direct method, and (c) Duncan's modification of Smith's direct method. Each method was examined for (a) rate of convergence, (b) frequency response to differences between the first guess temperature profile and the true temperature profile, and (c) the effects of noise on the radiance measurements. Details of the investigation and the results are presented in the report. GRA

N76-21817# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

ICE CAP ANALYSIS, ENERGY DEPOSIT AND TRANSPORT IN THE AURORAL IONOSPHERE. ICE CAP, 1973-1974, HAES REPORT NO. 5 Final Report, 14 May 1973 - 31 Dec. 1974

Robert D. Sears 8 Oct. 1975 59 p refs
(Contract DNA001-73-C-0224; DNA Proj. NWET-L25AAXYX966)
(AD-A018196; LMSC-D407248; DNA-3566F) Avail: NTIS CSCL 04/1

Analytical results describing the temporal and spatial history of energy deposit in the auroral ionosphere by precipitating particles are presented for the 1973 and '74 ICE CAP experiments. In addition, the role of neutral winds in transporting excited species which alters the expected spatial distribution of infrared radiance is described. Measurements of energy deposit and of Joule heating made by the Chatanika incoherent scatter radar and by optical photometric methods are compared quantitatively. The optical data are used to verify the radar technique for determining energy deposit by precipitating particles. Likewise, radar measurements of electric fields and Joule heating in the auroral ionosphere are used to quantitatively evaluate the three beam photometer method for computing electric fields and Joule heating. A method for determining the temporal and spatial structure of the magnetospheric-ionospheric electric fields is described and several spatial power spectra of the electric field structure during active periods are shown. GRA

N76-21818*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

THE MCDONNELL DOUGLAS GEOPHYSICAL OBSERVATORY PROGRAM PROGRESS REPORT 13 CONJUGATE POINT RIOMETER PROGRAM Final Report

Michael B. Baker Sep. 1975 53 p refs
(Contracts NAS5-924; F44620-73-C-0063; Grant NSF C-393; AF Proj. 9751)
(NASA-CR-146543; AD-A017688; MDC-G3540; AFOSR-75-1509TR) Avail: NTIS CSCL 04/1

This report, the thirteenth and final progress report on the McDonnell Douglas Geophysical Observatory Program, discusses history of the program from 1962 through 1973, and results of the research carried out in 1974. Topic areas covered include: Station operation; Ionospheric work; Solar studies, Magnetospheric studies; Satellite measurements; International participation; and, 1974 research on solar activity, ATS-6 studies, magnetospheric physics, and station operation. GRA

N76-21819# Alaska Univ., College. Geophysical Inst.

ARCTIC RADIATION FLUXES Annual Report, 1 Oct. 1974 - 30 Sep. 1975

Gunter Weller, K. O. L. F. Jayaweera, Takeshi Ohtake, Glenn Shaw, and Peter Weickmann 1 Nov. 1975 11 p
(Contract N00014-67-A-0317-0010)
(AD-A018183) Avail: NTIS CSCL 04/1

This report describes activities under the Contract during the period 1 October 1974 to 30 September 1975, at the Geophysical Institute, University of Alaska. During this year, our research efforts have concentrated on three general areas: (1) Collection of climatological radiation data at all four manned AIDJEX stations and publication of data from other Arctic stations; (2) Measurement and analysis of atmospheric turbidity and transmission of radiation, including study of ice crystals and acoustic soundings of the boundary layer; (3) Study of the large-scale features of Arctic stratus clouds, using satellites, and the microphysics of these clouds, using the NCAR Electra aircraft. The results of these studies continue to be published, and abstracts of publications which appeared during the contract period are included in this report. GRA

N76-21820# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SYSTEM FOR EXTINGUISHING SEISMIC WAVES

A. A. Vovk, G. I. Chernyi, V. I. Pulzhnik, V. P. Bondarenko, and A. A. Kuzmenko 19 Nov. 1975 8 p Transl. into ENGLISH from Russian Patent 343000, 22 Jun. 1972 p 1-2
(AD-A017886; FTD-ID(RS)I-2289-75) Avail: NTIS CSCL 19/4

A system is known for extinguishing seismic waves, which arise for example during an explosion, which is designed in the form of a chain of holes filled with porous material. The purpose of the invention is to raise the effectiveness of the extinguishing of seismic and surface waves. Blast holes are arranged in rows staggered around the source of the formation of seismic waves and the mouths of the holes are made with widened funnels. GRA

N76-21821# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
Pc1 AND Pc5 MICROPULSATION POLARIZATION PATTERNS Environmental Research Papers
John F. McClay 29 May 1975 31 p refs
(AF Proj. 7601)
(AD-A016398; AFCRL-TR-75-0307; AFCRL-ERP-534) Avail: NTIS CSCL 04/1

The position taken in this report is that the observable features of any pulsation or pulsation event are explained in terms of the physical properties of the eigenmodes of the system for a particular quasi-stationary state or a slowly varying sequence of quasi-stationary states. Discussed are: Field configuration of the eigenmodes for the resonance model; physical properties of polarization and magnetic energy density; latitudinal and diurnal variations in Pc4-5 H-D polarization patterns (including the demarcation latitude); and the simultaneous occurrence of left- and right-handed polarization in a Pc1 event. GRA

N76-21822# Systems Science and Software, La Jolla, Calif.
IMPROVED YIELD DETERMINATION AND EVENT IDENTIFICATION RESEARCH Quarterly Technical Report, 1 May - 31 Jul. 1975
J. T. Cherry, N. Rimer, J. M. Savino, and W. O. Wray 8 Aug. 1975 34 p refs
(Contract F08606-75-C-0045; ARPA Order 2551)
(AD-A017773; SSS-R-75-2696) Avail: NTIS CSCL 19/4

A one-dimensional parameter study which identifies the dependence of teleseismic magnitude on near source material properties was carried out. The major results of the material parameter sensitivity study may be summarized as follows: (1) increasing the air-filled porosity greatly reduces seismic coupling; (2) if any parameter describing the yield surface is varied such that the material strength is reduced, seismic coupling may be substantially enhanced; (3) seismic coupling is relatively insensitive to water content; a slight decoupling is observed with increasing water content; (4) increasing the overburden pressure substantially reduces seismic coupling. The near field coupling and the equivalent elastic source were computed for the recent underground explosion, Mast, at Pahute Mesa. The next step is to generate synthetic seismograms for this event at recently specified receiver locations. The enhanced computational capabilities for treating realistic earth structures will be exercised in this experiment. Author (GRA)

N76-21823# National Committee for Space Research, Haifa (Israel). Radio Observatory.
IONOSPHERIC RESEARCH USING SATELLITES Final Report, 1 Feb. 1972 - 1 Feb. 1975
Zvi Houminer, Israel Keroub, Jonathan Mass, and Avram Shuval Jun. 1975 38 p refs
(Contract F44620-72-C-0059; AF Proj. 4643)
(AD-A016365; AFCRL-TR-75-0449) Avail: NTIS CSCL 04/1

This report describes work done in continuation of research on the ionosphere's influence on satellite radio signals. Calculating the influence of the TEC (Total Electron Content) on the errors in the NNSS Satellite Navigation System, results are given in graphical form for different passes and TEC's. The theory for evaluating Faraday rotations without postulating quasi-longitudinal conditions is given. Several new methods to determine the TEC accurately from records including transverse propagation conditions are proposed. GRA

N76-21824# Boston Coll., Chestnut Hill, Mass.
CYLINDRICAL LANGMUIR PROBE MEASUREMENTS FROM ROCKET FLIGHTS COVERING THE PERIOD 31 JANUARY 1969 THROUGH 3 APRIL 1974
Robert C. Wilson 30 Apr. 1975 123 p refs
(Contract F19628-72-C-0089; AF Proj. 7663)
(AD-A016565; SR-1/2; AFCRL-TR-75-0265) Avail: NTIS CSCL 04/1

The current measurements made by cylindrical Langmuir probe systems flown on NIRO and Ute-Tomahawk vehicles are described. Particular emphasis is placed on the electron current and positive ion current. Measurements were made over an altitude range extending from 60 kilometers to 145 kilometers, thus, encompassing the D- and E- regions. The development of the electronic instrumentation is presented. GRA

N76-21825# Ohio State Univ., Columbus. Dept. of Geodetic Science.
EXTERNAL GRAVITY POTENTIAL OF THE EARTH, GRAVIMETRIC QUANTITIES AND GEODETIC PARAMETERS AFFECTED BY GRAVITY Final Report, 1 Jan. 1972 - 30 Jun. 1975
Urho A. Uotila Aug. 1975 47 p refs
(Contract F19628-72-C-0120; AF Proj. 8607)
(AD-A016491; DGS-229; AFCRL-TR-75-0431) Avail: NTIS CSCL 08/5

Subject matter includes such items as the use of gravity gradient measurements, the convergence problems in physical geodesy, least-squares collocation theory and applications, combination of satellite and gravimetry data, inversion of large symmetric matrices, covariance functions, anomaly degree variances, mass distribution in the earth's interior, role of altimeter data in the determination of mean gravity anomalies, refinement of modeling techniques for the determination of geopotential coefficients and computational techniques in gravimetry. Suggestions for further studies are made. GRA

N76-21826# Ohio State Univ., Columbus. Dept. of Geodetic Science.
COMPARISON OF UPWARD CONTINUED ANOMALIES COMPUTED BY THE POISSON INTEGRAL AND BY COLLOCATION Scientific Interim Report
Richard H. Rapp and Sammy I. Agajelu Jun. 1975 18 p refs
(Contract F19628-72-C-0120; AF Proj. 8607)
(AD-A016526; DGS-227; AFCRL-TR-75-0401; SR-26) Avail: NTIS CSCL 08/5

The computation of gravity anomalies at four altitudes, 6,096 km, 7,010 km, 9,144 km and 10,670 km, was carried out through the use of the standard Poisson integral, and through the use of the method of least squares collocation as implemented through a FORTRAN computer program written by Tscherning. In the comparison of the results the authors found (approximately) mean differences on the order of 0.5mgal, root mean square differences on the order of 10 percent. Specific values depended on how the collocation procedure was implemented and the heights involved. The computer time needed for the collocation procedure was greater than that needed for the Poisson Integral. In cases when an integral formula can be obtained for a desired quantity, the collocation process would take longer computationally. However there are many types of computations that can only be done using least squares collocation. GRA

N76-21827# Naval Postgraduate School, Monterey, Calif.
KINEMATICS OF SURF ZONE BREAKING WAVES: MEASUREMENT AND ANALYSIS M.S. Thesis
James Joseph Galvin Sep. 1975 97 p refs
(AD-A016382) Avail: NTIS CSCL 08/3

Simultaneous measurements of water surface fluctuations and horizontal water particle velocities in a line perpendicular to the direction of wave approach extending across the surf zone were taken in varying surf conditions at two locations. The spectral velocities calculated using linear theory as a transfer function underestimated measured values by 79-86% at the peak of the spectrum. The coherence values were generally low indicating non-linear and turbulent conditions. Strong harmonics in the spectra of the waves and water particle velocities further suggest a non-linear system. The theoretical phases computed using linear theory did not accurately predict the observed phases.

In general breaking waves can be characterized as a strongly non-linear wave phenomenon. Measured frequency distributions were compared with both Gaussian and Gram-Charlier distributions by using the chi-square goodness-of-fit test. Qualitatively, the Gram-Charlier distribution gave the better fit to the flow velocity data. GRA

N76-21828# Cornell Univ., Ithaca, N.Y. Water Resources and Marine Sciences Center.

INFLUENCE OF LAND DEVELOPMENT AND LAND USE PATTERNS ON WATER QUALITY

Charles D. Gates and Douglas A. Haith 1975 90 p refs
(Contract DI-14-31-0001-5032)
(PB-248071/3; W76-02637; OWRT-A-062-NY(1)) Avail: NTIS HC $5.00 CSCL 02C

Field, laboratory and statistical methods were used to study the influence of certain land uses on the waterborne export of certain wastes from a sewered urban area and from unsewered rural watersheds. Comparison, by means of mass balance analysis, of the amounts of biodegradable wastes in the Susquehanna River at stations above and below a 20.6 square mile developed area in Broome County, N. Y. indicated that the study area contributed carbonaceous BOD5 at the rate of 390 pounds per day per square mile to the River, averaged over the June-August 1973 and 1974 periods. The nature of the relationship between land use in and plant nutrient outputs from eighteen rural watersheds in the Cayuga Lake Basin was studied through use of regression analysis. The development of regression equations for nitrate and phosphate outputs from individual watersheds did not lead to the development of un-ambiguous quantitative relationships between land uses and nutrient concentrations. GRA

N76-21829# California Univ., Berkeley. Earthquake Engineering Research Center.

RELATIONSHIPS BETWEEN MAXIMUM ACCELERATION, MAXIMUM VELOCITY, DISTANCE FROM SOURCE AND LOCAL SITE CONDITIONS FOR MODERATELY STRONG EARTHQUAKES

H. Bolton Seed, Ramesh Murarka, and John Lysmer Jul. 1975 46 p refs
(Grant NSF GI-43104)
(PB-248172/9; EERC-75-17) Avail: NTIS HC $4.00 CSCL 08K

Results of a study are described to determine the influence of local geologic conditions on the attenuation of peak accelerations and peak velocities, with increasing distance from the source of energy release for earthquakes with a magnitude of about 6.5 occurring in the western part of the United States. While the results can only be considered to be strictly applicable to these conditions, it is hoped that they can also serve as a guide to possible relationships between peak accelerations and peak velocities which may be expected for earthquakes of higher magnitudes occurring in different locations. GRA

N76-21830# Newmark (Nathan M.) Consulting Engineering Services, Urbana, Ill.

STATISTICAL STUDIES OF VERTICAL AND HORIZONTAL EARTHQUAKE SPECTRA

W. J. Hall, B. Mohraz, and Nathan M. Newmark Jan. 1976 140 p refs
(Contract AT(49-5)-2667)
(PB-248232/1; NUREG-0003) Avail: NTIS HC $6.00 CSCL 08K

The study reveals that there is no well defined dependence of normalized seismic design response spectra on the earthquake ground acceleration level. Recommendations for horizontal design response spectra are close to those given in Regulatory Guide 1.60. Recommendations for vertical response spectra are somewhat lower than Regulatory Guide 1.60 provisions in the frequency range 2 to 30 hertz approximately. The results are based on seismic information recorded in the west coast of the United States and are directly applicable to that region only. GRA

N76-21831# Bureau of Mines, Denver, Colo. Mining Research Center.

DETECTION AND DELINEATION OF FAULTS BY SURFACE RESISTIVITY MEASUREMENTS. CONDA MINE, CARIBOU COUNTY, IDAHO

Robert Lee Stahl 1975 25 p refs
(PB-247222/3; BM-RI-8072) Avail: NTIS HC $3.50 CSCL 08G

Comprehensive field tests were made by the Bureau of Mines at the Conda open pit mine near Soda Springs, Idaho, to determine whether surface geophysical techniques could be used to detect and delineate faults in phosphate deposits. The tests included seismic refraction, magnetometer, electrical resistivity, and airborne photography. Of the several geophysical techniques tested in the field, horizontal resistivity profiling was most diagnostic of faults. The method is quick, inexpensive, and accurate and can be easily used by mining company personnel to detect and delineate faults. GRA

N76-21832# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

GEOMAGNETIC CUT-OFFS AT 1.7 AND 2.6 GV: TRANSMISSION FUNCTIONS AND ISOTOPIC ANALYSIS OF COSMIC RAY NUCLEI Interim Report

W. R. Webber, J. A. Lezniak, M. A. Shea, and D. F. Smart 26 Nov. 1975 9 p refs
(AF Proj. 8600)
(AD-A018092; AFCRL-TR-75-0598) Avail: NTIS CSCL 04/1

Details are obtained of both the isotopic composition of cosmic rays and the rigidity cut-off of the earth's magnetosphere by examining the pulse height distributions obtained for the various cosmic ray charges in a Cerenkov detector flown aboard a high altitude balloon at a latitude where the rigidity cut-off is slightly above the threshold energy of the Cerenkov detector or with a scintillation x total energy measurement when the rigidity cut-off is below the Cerenkov threshold. GRA

N76-21833# Alaska Univ., College. Geophysical Inst.

REPORT ON THE GEOPHYSICAL DESCRIPTION AND AVAILABLE DATA ASSOCIATED WITH ROCKET PF-C1-97

Gerald J. Romick L. G. Hanscom Field, Mass. AFCRL May 1975 42 p
(Contract F19628-74-C-0188; DNA Proj. NWET-L25AAXYX966)
(AD-A018055; AFCRL-TR-75-0327; SR-3) Avail: NTIS CSCL 04/1

This report describes the general auroral activity associated with the launch of rocket PF-C1-97 on U.T. 13 April 1975 at Poker Flat Research Range. Included in this report are peripheral data pertinent to the launch, and ground station instrumentation operation. GRA

N76-21834# Ballistic Research Labs., Aberdeen Proving Ground, Md.

MEASUREMENT OF THE MIXING RATIO PROFILE FOR WATER VAPOR AND NITROGEN DIOXIDE IN THE STRATOSPHERE Final Report

Donald E. Snider Oct. 1975 41 p refs
(DA Proj. 1T1-61102-B-53A; DNA Proj. NWED-QAXHD010)
(AD-A017887; BRL-1835) Avail: NTIS CSCL 04/1

Mixing ratios for water vapor and nitrogen dioxide between 22.4 and 28.4 km are derived using an infrared remote sensing technique. This technique employs a balloon-borne infrared spectrometer coupled to a biaxial solar pointing system to obtain atmospheric spectra using the setting sun as a source. These spectra were quantitatively interpreted using a single layer line-by-line analysis. Spectral line information, necessary for this type of analysis on the 6.532 - 6.653 micrometer water vapor features, was obtained from an AFCRL compilation. Line information for the 6.173 - 6.250 micrometer nitrogen dioxide features were generated in the course of this work. Results of this analysis for water vapor tend to support a 'dry' stratosphere, with a mixing ratio less than 10 ppmv. However, there is evidence that the water vapor mixing ratio tends to increase above the midlatitude tropopause. The volume mixing ratio for nitrogen dioxide increases from 0.4 ppbv at 16 km to 5 ppbv at 28.4 km with no evidence of a layer between these two altitudes. GRA

N76-21835# Naval Research Lab., Washington, D.C.

NUMERICAL MODELING OF AURORA, VOLUME 1 OF THE

CALENDAR YEAR 1974 ANNUAL REPORT TO THE DEFENSE NUCLEAR AGENCY. HAES REPORT NO. 16
Oct. 1975 71 p refs
(DNA Proj. NWET-L25AAXHX633; NRL Proj. H02-35)
(AD-A017729; NRL-MR-3120-Vol-1) Avail: NTIS CSCL 04/1

In support of High Altitude Nuclear Explosion (HANE) phenomenology the NRL Plasma Physics Division has developed theoretical models for many of the important features of the aurora. This report describes the auroral modeling results for the energy deposition of energetic electrons and ions (protons) in the atmosphere, the effects of the energy deposition on the chemistry of the auroral ionosphere, and the effects of auroral ionization in the electric fields and currents at high latitudes. These model results provide a valuable link between the existing and ongoing auroral measurements and the HANE phenomenology simulations. GRA

N76-21836# Naval Research Lab., Washington, D.C.
A SEMI-SPECTRAL NUMERICAL MODEL FOR FORCED, VERTICALLY PROPAGATING PLANETARY WAVES. PART 1: APPLICATION OF THE MODEL TO LINEAR DIURNAL AND SEMI-DIURNAL ATMOSPHERIC THERMAL TIDES
Rangarao V. Madala, S. A. Piacsek, and S. T. Zalesak Oct. 1975 59 p refs
(DNA Proj. NWED-QAXHC065; NRL Proj. H02-36)
(AD-A018013; NRL-MR-3145-Pt-1) Avail: NTIS CSCL 04/1

A three dimensional, semi-spectral, numerical model is developed for forced, vertically propagating planetary waves and is used to simulate atmospheric diurnal and semi-diurnal thermal tides. The physical model is the same as the one developed by Lindzen (1971) for tides, except that the equation normally used for height is used as the vertical coordinate instead, and an initial value approach is used to obtain the steady state instead of the eigenvalue approach used by Lindzen (1971). In the semi-spectral method all the variables are expanded in Fourier series in the E-W direction, and are specified on a mesh of equally spaced grid points in N-S direction. The vertical direction is divided into a number of layers with variable thicknesses. The free modes generated by imperfect initial conditions are dissipated by using a transient Rayleigh friction decaying in time. Reflections of the vertically propagating waves from the top boundary are avoided by absorbing them in a sponge layer, in which Rayleigh friction increase exponentially with height. The model is integrated by using a two step predicted-corrector (leapfrog-trapezoidal) time integration scheme, and is driven by the diurnal and semi-diurnal heating function given by Lindzen (1971). Comparison of the numerical results with the analytical solutions of Lindzen (1971) show that the model reproduced the tidal oscillations very well. GRA

N76-21837# Colorado Univ., Boulder. Dept. of Mechanical Engineering.
FAULTING IN GEOTHERMAL AREAS
John S. Rinehart 11 Sep. 1975 40 p refs
(Grant NSF AER-74-03429)
(PB-247071/4; CUMER-75-12; NSF/RA/N-75-128) Avail: NTIS HC $4.00 CSCL 08G

This report describes fault systems that are present in known geothermal areas. It was written primarily to provide an introduction to the subject of the nature and occurrence of faults for nongeologists working in the field of geothermal energy development, especially the character of flow of fluids in the basins. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N76-21838*# Transemantics, Inc., Washington, D.C.
DETERMINATION OF THE EFFECTIVE TEMPERATURE OF LIQUID-DROP CLOUD FORMATIONS BY THE THERMAL RADIATION OF THE ATMOSPHERE IN THE UHF BAND
L. M. Mitnik NASA Mar. 1976 17 p refs Transl. into ENGLISH from Sputnikovaya Meteorol., tr. no. 148, Gidrometeoizdat (Leningrad), 1974 p 115-125
(Contract NASw-2792)
(NASA-TT-F-16928) Avail: NTIS HC $3.50 CSCL 04B

Various subjects related to atmospheric physics were discussed. Determination of the following parameters affecting cloud formation were investigated: height of the upper and lower boundaries, phase composition, distribution of the water content and temperature in the clouds, water supply, etc. The fundamental means of estimating the cloud band temperature by the thermal radiation of the atmosphere in the UHF band were also clarified. The function of the absorption spectrum of liquid-drop clouds on temperature was examined. Author

N76-21839*# City Coll. of the City Univ. of New York.
MONTHLY MEAN FORECAST EXPERIMENTS WITH THE GISS MODEL
Jerome Spar, Robert Atlas, and Eugene Kuo Mar. 1976 77 p refs
(Grant NGR-33-013-086)
(NASA-CR-146813; Contrib-41) Avail: NTIS HC $5.00 CSCL 04B

The GISS general circulation model was used to compute global monthly mean forecasts for January 1973, 1974, and 1975 from initial conditions on the first day of each month and constant sea surface temperatures. Forecasts were evaluated in terms of global and hemispheric energetics, zonally averaged meridional and vertical profiles, forecast error statistics, and monthly mean synoptic fields. Although it generated a realistic mean meridional structure, the model did not adequately reproduce the observed interannual variations in the large scale monthly mean energetics and zonally averaged circulation. The monthly mean sea level pressure field was not predicted satisfactorily, but annual changes in the Icelandic low were simulated. The impact of temporal sea surface temperature variations on the forecasts was investigated by comparing two parallel forecasts for January 1974, one using climatological ocean temperatures and the other observed daily ocean temperatures. The use of daily updated sea surface temperatures produced no discernible beneficial effect. Author

N76-21840*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
ESTIMATION OF DAILY MEAN AIR TEMPERATURE FROM SATELLITE DERIVED RADIOMETRIC DATA
Dale Phinney Jan. 1976 75 p
(Contract NAS9-12200)
(NASA-CR-147517; LEC-7852; JSC-10920) Avail: NTIS HC $4.50 CSCL 04B

The Screwworm Eradication Data System (SEDS) at JSC utilizes satellite derived estimates of daily mean air temperature (DMAT) to monitor the effect of temperature on screwworm populations. The performance of the SEDS screwworm growth potential predictions depends in large part upon the accuracy of the DMAT estimates. Author

N76-21841*# Chicago Univ., Ill. Dept. of Geophysical Sciences.
SPEARHEAD ECHO AND DOWNBURST NEAR THE APPROACH END OF A JOHN F. KENNEDY AIRPORT RUNWAY, NEW YORK CITY
T. Theodore Fujita Mar. 1976 53 p refs
(Grant NGR-14-001-008; NOAA-04-4-158-1(NESS))
(NASA-CR-146561; SMRP-RP-137) Avail: NTIS HC $4.50 CSCL 01E

Radar echoes of a storm at John F. Kennedy International Airport are examined. Results regarding the phenomena presented suggest the existence of downburst cells. These cells are characterized by spearhead echoes. About 2% of the echoes in the New York area were spearhead echoes. The detection and identification of downburst cells, their potential hazard to approaching and landing aircraft, and communication of this information to the pilots of those aircraft are discussed. Author

N76-21842# Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
AUTOMATED DATA SYSTEM FOR EMERGENCY METEOROLOGICAL RESPONSE
C. D. Kern 1975 15 p Presented at 3d ERDA Environ.

Protect. Conf., Chicago, 23-25 Sep. 1975
(Contract AT(07-2)-1)
(DP-MS-75-83; Conf-750967-3) Avail: NTIS HC $4.00

The Savannah River Plant (SRP) releases small amounts of radioactive nuclides to the atmosphere as a consequence of the production of radioisotopes. To provide for emergency meteorological response to accidental releases and to conduct research on the transport and diffusion of radioactive nuclides in the routine releases, a series of high-quality meteorological sensors have been located on towers in and about SRP. These towers are equipped with instrumentation to detect and record temperature and wind turbulence. Should there be an accidental release to the atmosphere, available recorded data and computer codes would allow the calculation and display of the location, time, and downwind concentration of the atmospheric release. These data are made available to decision makers in near real-time to permit rapid decisive action to limit the consequences of such accidental releases. Author (NSA)

N76-21843# Bonn Univ. (West Germany). Inst. fuer Meteorologie.
TROPICAL CIRCULATION TYPES IN THE LIGHT OF SATELLITE PHOTOGRAPHY [TROPISCHE ZIRKULATIONSFORMEN IM LICHTE DER SATELLITENAUFNAHMEN]
Hermann Flohn Opladen, West Ger. Westdeutscher Verlag 1975 85 p refs Repr. from Forschungsber. des Landes Nordrhein-Westfalen, no. 2448, 1975 In GERMAN
(Bonn-Mi-21-1975; ISBN-3-531-02448-5) Avail: NTIS HC $5.00

Quasisteady high altitude troughs are projected into the interaction between the phenomena of the tropical Hadley cell and the extratropical Ferrel circulation, based on the interpretation of satellite photography. It is shown that tropical circulation varies strongly with longitude. The longitudinal differences can be interpreted by using data of ground level heat budget and an estimation of the heat balance of an atmospheric column. ESA

N76-21844# Bonn Univ. (West Germany). Inst. fuer Meteorologie.
MATERIAL ON THE DEVELOPMENT OF THE INDIAN SUMMER MONSOON [MATERIALIEN ZUR ENTWICKLUNG DES INDISCHEN SOMMERMONSUNS]
M. Wagner (Deut. Wetterdienst) and E. Ruprecht (Cologne Univ.) Ferd. Duemmler's Verlag 1975 105 p refs In GERMAN; ENGLISH summary
(Bonn-Mi-23-1975; ISBN-3-47-75831-1) Avail: NTIS HC $5.50; Ferd. Duemmler's Verlag DM 26

The development is described by means of meridian sections along 77 deg E of the zonal wind component and the temperature and by synoptic charts of the 850, 700, 500, and 300 mb level. Basic data are from aerological ascents for the periods May-July 1956 and May-June 1957. The monsoon is discussed as part of the general tropical circulation, which is strongly affected by orography above southern Asia. The subtropical jet stream causes the shifting of three wind belts working together during the monsoon. ESA

N76-21845# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYNOPTIC CONDITIONS FOR ICING OF WIRES ON PLANNED RUN OF NUREKTASHKENT POWER LINES
A. S. Volkov and L. A. Savchenko 12 Nov. 1975 12 p Transl. into ENGLISH from Tr. Sredneazyatskii Nauchno-issled.-Atelskii Gidrometerologicheskii Inst. (USSR), v. 72, no. 57, 1972 p 206-210
(AD-A017885; FTD-ID(RS)I-2288-75) Avail: NTIS CSCL 08/12

Weather maps, constant pressure maps and aerological diagrams from the Dushanbinskiy Weather Bureau for 1956-1965 were used for the analysis. 452 days were examined in all during which icing and rime phenomena were observed even at one weather station located close to the planned run of the power line. Icing and rime phenomena were observed in the region of the power line run during six types of synoptic processes (according to the classification of Central Asian weather forecasters. The recurrence of the number of days with icing (%) was calculated independent of the weight of the accretion and separately for cases when the weight of the accretion was 100 g or more. GRA

N76-21846# Informatics, Inc., Rockville, Md.
SOVIET DEVELOPMENTS IN WEATHER MODIFICATION, CLIMATE MODIFICATION, AND CLIMATOLOGY Interim Report
G. S. Gordon Sep. 1975 93 p refs
(Contract MDA903-76-C-0099)
(AD-A017675) Avail: NTIS CSCL 04/2

This report focuses on Soviet developments in weather modification, climate modification, and climatology during the period from late 1973 through mid-1975. Current Soviet work in solar meteorology and laser applications in atmospheric sounding are also surveyed. The source literature includes regular Soviet scientific journals, recent monographs, popular science periodicals, and the daily press. Author (GRA)

N76-21847# Colorado Univ., Boulder. Dept. of Computer Science.
SOFTWARE TOOLS FOR CLIMATE SIMULATION Final Report
John M. Gary 1975 88 p refs
(Grant AF-AFOSR-2732-74; ARPA Order 2792)
(AD-A017664; AFOSR-75-1530TR) Avail: NTIS CSCL 04/2

The macro preprocessor provides a standard type of macro replacement with arguments for FORTRAN programs. Conditional macro expansion and macro time arithmetic computation is included. Structured control statements (IF...THEN..., etc.) are added to FORTRAN. A preprocessor for FORTRAN containing macro capability, vector arithmetic, and finite difference operators was designed, but only partially implemented. A first version of a package for the solution of hyperbolic-elliptic equations was implemented, but is not yet documented. Author (GRA)

N76-21848# Naval Postgraduate School, Monterey, Calif.
RADIATIONAL PARAMETERIZATION FOR THE FNWC PRIMITIVE EQUATION MODEL USING DATA OVER THE OCEANS FOR 16 APRIL 1974 M.S. Thesis
William Thurman Meyers Sep. 1975 131 p refs
(AD-A016379) Avail: NTIS CSCL 04/2

The radiational model used in this study computes the planetary albedo and absorption of solar insolation by the ocean's surface and by atmospheric layers for the primitive equation model of FNWC. Large-scale cloud parameterization in several layers was used in these computations. Solar insolation disposition was computed from the water-mass and the cloud amounts over each gridpoint. Long-wave cooling effects were computed using emissivity formulas after Sasamori at the earth's surface and over the same layers, and were also found to be dependent upon the cloud parameterization. Two forms of the cloud parameterization were tested using FNWC data over the oceanic gridpoints for 16 April 1974. The objective was to determine the parameterization which better verified the radiational balance as a function of latitude when compared with satellite climatology at the top of the atmosphere for the same general data-period in 1969 (after Raschke, et al, 1973). The better verification resulted with the smaller cloud parameterization values. GRA

N76-21849# Calspan Corp., Buffalo, N.Y.
MARINE FOG STUDIES OFF THE CALIFORNIA COAST Annual Summary Report
Eugene J. Mack, Roland J. Pillie, and Ulrich Katz Mar. 1975 87 p refs
(Contract N00019-75-C-0053)
(AD-A016958; CALSPAN-CJ-5607-M-1; ASR-3) Avail: NTIS CSCL 04/2

Contents: Summary of marine fog occurrence off the West Coast; The importance of organized vertical motions in coastal fog; Bay fog (marine fog formation through continental influences); Observations of a mesoscale organization of fog occurrence off the West Coast. GRA

N76-21850# National Weather Service, Honolulu, Hawaii.
FORECASTING HURRICANES IN THE CENTRAL PACIFIC
Paul Haraguchi Oct. 1975 18 p
(PB-248371/7; NOAA-TM-NWS-PR-13; NOAA-75112801) Avail: NTIS HC $3.50 CSCL 04B

The various hurricanes and tropical storms that have occurred in Hawaii in recent years (1950-1974) are discussed. The climatological tracks, features, and movement of these storms as they occurred in the Central Pacific are given along with the forecast procedures for such storms. A list of figures is shown that gives the tracks of all the hurricanes and tropical storms that have occurred in the Central Pacific during the period 1949-1974. GRA

N76-21851# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.

A CLIMATOLOGY OF INVERSIONS

George J. Schewe 1975 118 p refs

(Grant NSF GI-44423)

(PB-247704/0; AS-Paper-238) Avail: NTIS HC $5.50 CSCL 04B

Stratifications and analysis of acoustic radar records are performed for the Ft. Collins area of Colorado. Two months of daily continuous data are used from the winter of 1975. Frequencies of occurrence of inversions in time and space are found and stratified in several ways. These include stratification by time of day, thickness, persistance and type of inversion (elevated or surface based). Associations with routine meteorological measurements such as wind speed, wind direction, cloud cover, etc., are also performed. Finally, CO concentrations, available on a fairly routine basis, were associated with inversion occurrences. GRA

N76-21852# National Oceanic and Atmospheric Administration, Washington, D.C. Center for Experiment Design and Data Analysis.

BOMEX WIND SPECTRA DERIVED FROM THE BOUNDARY LAYER INSTRUMENT PACKAGE (BLIP)

C. F. Ropelewski Sep. 1975 21 p refs

(PB-248434/3; NOAA-TM-EDS-BOMAP-17; NOAA-75120205) Avail: NTIS HC $3.50 CSCL 04B

Spectral analysis of wind time-series data obtained with the Boundary Layer Instrument Package during the Barbados Oceanographic and Meteorological Experiment in 1969 show the spectra to be contaminated by ship and balloon motion only at the very high frequencies (0.11 to 0.07 Hz). Spectra for undisturbed weather show the existence of weak eddies with wavelengths centered near 300 m, while those for disturbed conditions indicate energetic two-dimensional eddies with wavelengths of up to several hundred meters. GRA

N76-21853# National Weather Service, Silver Spring, Md. Office of Hydrology.

MOISTURE SOURCE FOR THREE EXTREME LOCAL RAINFALLS IN THE SOUTHERN INTERMOUNTAIN REGION

E. Marshall Hansen Nov. 1975 65 p refs

(PB-248433/5; NOAA-TM-NWS-HYDRO-26; NOAA-75120101) Avail: NTIS HC $4.50 CSCL 04B

Three cases of extreme local precipitation within the Intermountain summer season were studied to determine the source of moisture for these events. Synoptic data were used to analyze surface and upper level moisture changes in time and space. In each case the study showed that a tongue of high moisture at low levels approached the vicinity of or encompassed the storm area prior to onset of the rain. The tongue of moisture was very narrow and could be traced, through continuity of changes in pattern with time, back to the gulf of California. A general conclusion is that greater emphasis be given to tropical pacific moisture in evaluating extreme summer precipitation values for the Intermountain region. GRA

N76-21854# National Environmental Satellite Service, Washington, D.C.

MONTHLY WINTER SNOWLINE VARIATION IN THE NORTHERN HEMISPHERE FROM SATELLITE RECORDS, 1966-75

Donald R. Wiesnet and Michael Matson Nov. 1975 27 p refs

(PB-248437/6; NOAA-TM-NESS-74; NOAA-75120904) Avail: NTIS HC $4.00 CSCL 04B

The application of satellite imagery for detecting, measuring, and mapping mean monthly winter snow cover over the Northern Hemisphere is demonstrated. Maps and graphs are used to depict snow cover for North America, Eurasia, and Northern Hemisphere for the months of December through March for the period 1966-75. Although snow cover over North America tended to be fairly uniform during the 9-year period, over Eurasia and the Northern Hemisphere a cyclical pattern is evident. The NOAA satellites provide a reliable means of monitoring worldwide snow cover, which has important effects on global temperature and albedo. GRA

N76-21855# National Oceanic and Atmospheric Administration, Boulder, Colo. Weather Modification Program Office.

LINEAR STABILITY ANALYSIS OF CISK-INDUCED LOW LATITUDE DISTURBANCES

Walter James Koss Nov. 1975 178 p refs

(PB-248450/9; NOAA-TM-ERL-WMPO-24; NOAA-75120208) Avail: NTIS HC $7.50 CSCL 04B

The physical stability of perturbation motions in a conditionally unstable tropical atmosphere at rest is examined under conditional instability of the second kind (CISK) and frictional forcing. The governing linear multi-layer primitive equations are formulated into an eigenvalue problem for the unconditional heating case. This analysis yields propagation speeds, growth rates, and vertical structure for the modes supported by the model. The specified parameters are the vertical distribution of diabatic heating, the base state temperature structure, boundary layer specific humidity, lateral mixing coefficients for momentum and temperature, surface friction coefficient, coriolis parameter and perturbation wavelength. GRA

N76-21856# Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.

FLOW DYNAMICS OF A TORNADO-LIKE VORTEX FLOW

M. C. Jischke and M. Parang Aug. 1975 216 p refs

(Grants NOAA-N22-200-72(G); NOAA-04-4-022-13)

(PB-248463/2; NOAA-75120102) Avail: NTIS HC$7.75 CSCL 04B

A swirling, coverging vortex flow is studied both experimentally and theoretically as a model of tornado flowfield. Using a nonequilibrium condensation process as a basis, distinctions between the observed tornado funnel and other aspects of the core flow are discussed. It is found that the swirling, converging vortex flow is a realistic model of tornadoes. The laboratory measurements show an outer inviscid region with core dimensions primarily determined by inviscid dynamics and the pressure boundary condition aloft. Convergence in the inviscid flow region is shown to be reponsible for such experimentally observed features as boundary-layer separation and reattachment. GRA

N76-21857# National Environmental Satellite Service, Coral Gables, Fla. Satellite Field Services Station.

SAHARA DUST OVER THE ATLANTIC

B. May Mayfield Nov. 1975 73 p refs

(PB-248452-11-3; NOAA-75120801-3) Avail: NTIS; Environmental Data Service, D762, Page Building 1, Room 400, Washington, D. C. 20235 CSCL 04B

A series of pictures is decribed of an area of dust that was photographed over the Atlantic and Carribean area. These photographs were taken from geostationary satellites which are used to witness the evolution of weather systems over the oceans. Two mile resolution visible spectrum pictures are shown of an area of dust that had its origin over the Sahara Desert. GRA

N76-21858# Research Triangle Inst., Research Triangle Park, N.C.

RANN UTILIZATION EXPERIENCE. CASE STUDY NO. 11: NATURAL HAZARDS

W. D. Bach 1975 20 p refs Prepared in part by Colo. Univ.

(Contract NSF C-927)

(PB-247255/3; NSF/RA/G-75-039) Avail: NTIS HC $3.50 CSCL 13L

Information is provided on immediate policy alternatives and evaluations of existing research concerning such hazards as floods, earthquakes, and hurricanes. The research focused on analysis of: (1) Existing data; (2) the quality of the data; (3) the effectiveness of methods for coping with hazards; (4) the probable effectiveness of alternative methods; and (5) the costs and benefits of the various methods. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N76-21859# Scripps Institution of Oceanography, San Diego, Calif. Visibility Lab.
AN INSTRUMENT FOR THE MEASUREMENT OF SPECTRAL ATTENUATION COEFFICIENT AND NARROW ANGLE VOLUME SCATTERING FUNCTION OF OCEAN WATERS Final Report, Mar. 1973 - Jun. 1975
R. W. Austin and T. J. Petzold Sep. 1975 13 p Presented at the Ocean Optics Seminar of the Soc. of Photo-Optical Instrumentation Eng. Ann. Tech. Symp., 19 Aug. 1975
(Contract N66857-73-C-0146; ARPA Order 2431)
(AD-A017878; SIO-Ref-75-25) Avail: NTIS CSCL 08/10

A new instrument has been developed for the study of those optical properties of ocean water that affect the transmission of image-forming light. The instrument performs simultaneous measurements of the volume attenuation coefficient and the volume scattering function at three angles. Any of ten wavelengths covering the spectral range from 400 to 670 nanometers may be used. A depth capability of 500 meters permits the examination of water below the euphotic zone and the bottom waters on the continental shelf. The considerations leading to the design of the instrument, its capabilities and the unique features it incorporates are discussed. Some examples of the data obtained with the instrument are presented. GRA

N76-21860# Naval Research Lab., Washington, D.C.
OCEAN SCIENCES DIVISION: RECENT DEVELOPMENTS IN INSTRUMENTATION AND TECHNIQUES Final Report
Richard Nekritz Nov. 1975 26 p
(AD-A018133; NRL-MR-3150) Avail: NTIS CSCL 08/3

Since 1966, when the Ocean Sciences Division originated, its scientists have developed a variety of instruments and techniques to apply to their studies of marine chemistry, air-sea interactions, air-mass trajectories, fog generation, pollution, and ocean turbulence. This report describes several of these developments, some of which may be applicable to the scientific or technical problems of other investigators. Author (GRA)

N76-21861# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Hydraulics Lab.
SHORE EFFECT MODEL, ATLANTIC GENERATING STATION HYDRAULIC MODEL INVESTIGATION Final Report, Oct. 1973 - Dec. 1974
Robert D. Carver, D. Donald Davidson, Robert W. Whalin, and John H. Barwis Nov. 1975 87 p refs
(AD-A017793; WES-TR-H-75-16) Avail: NTIS CSCL 08/3

A distorted-scale hydraulic model investigation was performed to determine the potential effect, if any, of a proposed offshore nuclear power plant on shoreline evolution. Model measurements of current patterns with and without the breakwater were directly compared and measurements of breaking wave characteristics (height, depth, and angle to shoreline) with and without the breakwater were used to calculate and compare longshore transport rates in the potentially affected areas. It was concluded that the proposed construction would have a negligible effect on future shoreline evolution. Author (GRA)

N76-21862# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
FINAL REPORT Final Report, 1 Sep. 1973 - 30 Sep. 1975
John M. Dahlen Nov. 1975 15 p refs
(Contract N00014-74-C-0163; NR Proj. 083-318)
(AD-A018076; C-4552) Avail: NTIS CSCL 08/3

This letter report summarizes the work performed by CSDL and refers to technical reports, papers, and journal articles for detailed documentation. Instrumentation development for internal wave investigation and ocean deployments in direct engineering support of M.I.T. ocean science programs are described. This work entails active field programs with two advanced arrays making fundamental measurements of internal waves and microstructure in the open ocean -- the Microscale Sensing Array (MSA) and the Intermediate Internal Wave Array (IIWA). These systems were designed to complement earlier ONR-sponsored arrays: Bermuda Buoy (1970-71) and Ocean Telescope (1967-69). Theoretical and experimental investigation of techniques required for optimum interpretation of oceanographic measurements obtained from moored buoy systems are also described. This work has focused upon the basic dynamic measurement problems encountered in the above-mentioned M.I.T. program and in WHOI moored array experiments. GRA

N76-21863# Tetra Tech, Inc., Pasadena, Calif.
COMPUTER PREDICTION OF NEARSHORE AND SURF ZONE STATISTICS Final Report
Choule J. Sonu Sep. 1975 131 p refs
(Contract N00014-69-C-0107)
(AD-A018008; TETRAT-TC-394) Avail: NTIS CSCL 08/3

For the purpose of aiding in the strategic planning of naval inshore warfare operations, a study has been performed to develop prediction technology for shallow water waves, breakers, and longshore current velocities, using the visually observed deep water wave statistics as input. Computer programs, code-named 'BREAKM' and 'STATBR,' and various nomographs have been developed to permit predictions for both physical magnitude and long-term statistics. Information display formats have been developed with a view to permitting speedy review of various key physical parameters and comparison between adjacent regions. Predicted results compare reasonably well with visually observed nearshore data, provided that a tolerable amount of discrepancy exists due partly to local conditions not accounted for in our prediction, partly to the built-in safety margin in our prediction, and partly to the limitations inherent to the state of the art. Author (GRA)

N76-21864# Woods Hole Oceanographic Institution, Mass. Dept. of Ocean Engineering.
CURRENT MEASUREMENT SYSTEM DESIGN SUPPORT, VOLUME 1 Final Report
Robert G. Walden 14 Jun. 1975 397 p 2 Vol.
(Contract N62477-74-C-0080)
(AD-A018048) Avail: NTIS CSCL 08/3

The report documents the design support and engineering services provided to the Naval Facilities Engineering Command to establish a system to reliably measure deep ocean currents in support of ocean engineering and construction projects. The report includes an environmental model, a survey of current meters, moor/meter interaction analysis, subsystem tests, system trade-off studies, system design and procurement specifications. GRA

N76-21865# Woods Hole Oceanographic Institution, Mass.
CURRENT MEASUREMENT SYSTEM DESIGN SUPPORT, VOLUME 2 Final Report
Robert G. Walden 14 Jun. 1975 297 p refs 2 Vol.
(Contract N62477-74-C-0080)
(AD-A018049) Avail: NTIS CSCL 08/3

The report documents the design support and engineering services provided to the Naval Facilities Engineering Command to establish a system to reliably measure deep ocean currents in support of ocean engineering and construction projects. The report includes an environmental model, a survey of current meters, moor/meter interaction analysis, subsystem tests, system trade-off studies, system design and procurement specifications. GRA

N76-21866# Scripps Institution of Oceanography, La Jolla, Calif.
CALIFORNIA COOPERATIVE OCEANIC FISHERIES INVESTIGATIONS, ATLAS NO. 22
Jerome Namias Jun. 1975 253 p refs
(Contract N00014-75-C-0260; Grant NSF AG-74-24592)
(PB-248047/3; NSF/IDOE-75-77) Avail. NTIS HC $9.00 CSCL 04B

The report is the twenty-second in a series of atlases containing data on the hydrography and plankton from the region of the California current. Although originally designed for climatological and long range forecasting work, seasonal mean sea level pressure charts and their deviations from long period averages are becoming increasingly useful for many interdisciplinary environmental studies. These charts give mean sea level isobars, and isopleths of deviation from the 26-year mean (1947-1972) which may be called a 'normal' base period. A number of scientists-meteorologists, oceanographers, fisheries experts, chemists, etc-have requested such charts to help explain environmental variations germane to their research. The charts

and digital data in this atlas have been prepared to aid such groups. GRA

N76-21867# Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
COASTAL UPWELLING EXPERIMENT. 2: HYDROGRAPHIC DATA, REPORT. R/V YAQUINA CRUISES Y7307-B AND Y7308-A (15-18 JULY AND 16-20 AUGUST 1973). R/V CAYUSE CRUISE C7308-E (18-31 AUGUST 1973)
Thomas B. Curtin, Walter R. Johnson, and Christopher N. K. Mooers Jan. 1975 105 p refs
(Grant NSF GX-31264)
(PB-248189/3; UMRSMAS-75003; NSF/IDOE-75-76) Avail: NTIS HC $5.50 CSCL 08C

The report includes data from two cruises of the R/V YAQUINA and one cruise of the R/V CAYUSE during the summer of 1973. The purpose of these cruises was to make detailed hydrographic and current profiles in a coastal upwelling frontal zone. Several modes of operation were implemented during the three cruises. High resolution (both horizontal and vertical) cross sections; alongshore mapping patterns; fixed location time series analysis inshore, small-scale cross sections; and fixed position moorings were all used in the effort to examine the details of the coastal upwelling mesoscale processes. GRA

N76-21868# Hawaii Inst. of Geophysics, Honolulu.
THE EFFECT OF TOPOGRAPHY ON THE ELECTROMAGNETIC FIELDS INDUCED BY PLANE-PARALLEL BAROTROPIC OCEAN WAVES
Michael A. Sklarz Jul. 1975 317 p refs Sponsored by NOAA
(PB-248449/1; HIG-75-16; NOAA-JTRE-139; NOAA-75120113) Avail: NTIS HC $9.75 CSCL 08J

As a time-harmonic plane water wave progresses through an electrically conducting sea, over a rotating, conducting earth and under a nonconducting atmosphere, electric and magnetic fields are induced above, within, and below the sea. In the event of plane parallel (two-dimensional) ocean bottom topography, the topography gives rise to a diffracted water wave, and then interacts with its associated electromagnetic fields as well as those induced by the incident wave. The effect of such topography is investigated by means of a first order perturbation to both the hydrodynamics and electromagnetics of a free, plane-parallel, barotropic, semidiurnal tidal wave moving over a plane-parallel Gaussian hump through a uniformly conducting sea. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N76-21869*# Food and Drug Administration, Cincinnati, Ohio.
ECOLOGY AND THERMAL INACTIVATION OF MICROBES IN AND ON INTERPLANETARY SPACE VEHICLE COMPONENTS Quarterly Progress Report, 1 Oct. - 31 Dec. 1975
A. L. Reyes and J. E. Campbell Mar. 1976 27 p refs
(NASA Order W-13411)
(NASA-CR-146549; QPR-43) Avail: NTIS HC $4.00 CSCL 06M

The heat resistance of Bacillus subtilis var. niger was measured from 85 to 125 C using moisture levels of % RH < or = 0.001 to 100. Curves are presented which characterize thermal destruction using thermal death times defined as F values at a given combination of three moisture and temperature conditions. The times required at 100 C for reductions of 99.99% of the initial population were estimated for the three moisture conditions. The linear model (from which estimates of D are obtained) was satisfactory for estimating thermal death times (% RH < or = 0.07) in the plate count range. Estimates based on observed thermal death times and D values for % RH = 100 diverged so that D values generally gave a more conservative estimate over the temperature range 90 to 125 C. Estimates of Z sub F and Z sub L ranged from 32.1 to 58.3 C for % RH of < or = 0.07 and 100. A Z sub D = 30.0 was obtained for data observed at % RH < or = 0.07. Author

N76-21870*# Kanner (Leo) Associates, Redwood City, Calif.
THE GERMICIDAL EFFECTIVENESS OF ETHYLENE OXIDE/CARBON DIOXIDE AS COMPARED WITH STEAM
F. Dosch Washington NASA Apr. 1976 6 p refs Transl. into ENGLISH from Zentr. Bakteriol., Parasitenk., Erste Abt. Orig. (Jena), no. 184, 1962 p 201-203
(Contract NASw-2790)
(NASA-TT-F-17006) Avail: NTIS HC $3.50 CSCL 06M

A mixture of 15% ethylene oxide and 85% carbon dioxide at 55 C proved to be just as effective as steam at 133 C in killing microorganisms, with the most resistant native spores surviving no longer than 30 minutes. Author

N76-21871*# Joint Publications Research Service, Arlington, Va.
SURPRISES OF SPACE BIOLOGY
B. Gerasimov Washington NASA Apr. 1976 5 p Transl. into ENGLISH from Sots. Industriya (USSR), no. 32, 8 Feb. 1976 p 4
(NASA Order W-13183)
(NASA-TT-F-16985) Avail: NTIS HC $3.50 CSCL 06B

Various organisms which were aboard the landing biosatellite Cosmos-782 were studied upon their return to earth. One of the main tasks of this mission was to determine the pure effect of weightlessness on live organisms. Because 6-7 hours after the landing the organisms begin to be subjected to the effect of g-loads, vibration, and change in temperature, it is important to study them at once after their arrival. Then they are taken to Moscow for additional study. Artificial gravity was created aboard Cosmos-782. Plants which were in an onboard centrifuge (which created the gravity force) developed better than those subjected to weightlessness. For the first time, guppies gave birth in space. Author

N76-21872# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
USE OF REVERSE OSMOSIS AND ULTRAFILTRATION FOR REMOVING MICROORGANISMS FROM WATER Report for Nov. 1971 - Oct. 1972
Johann A. Hinterberger, Don C. Lindsten, and Allen Ford Sep. 1974 66 p refs
(DA Proj. 1G7-62708-DJ-39)
(AD-A008331; USAMERDC-2111) Avail: NTIS CSCL 13/2

The report covers the investigation of the capability of reverse osmosis and ultrafiltration membrane water purification systems in removal of bacteria from water. Results of the study indicate that reverse osmosis and ultrafiltration membranes are highly effective in removal of bacteria from water. Performance, operating procedures, and design are discussed. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N76-21873*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 152, MARCH 1976
Mar. 1976 75 p refs
(NASA-SP-7011(152)) Avail: NTIS HC $4.50 CSCL 06E

This bibliography lists 252 reports, articles, and other documents introduced into the NASA scientific and technical information system in February 1976. Author

N76-21874*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CUMULATIVE INDEX TO A CONTINUING BIBLIOGRAPHY
Jan. 1976 470 p Supersedes the indexes contained in supplements NASA-SP-7011(138) through NASA-SP-7011(149)
(NASA-SP-7011(150)) Avail: NTIS HC $9.00 CSCL 06E

This publication is a cumulative index to the abstracts contained in Supplements 138 through 149 of AEROSPACE

MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY. It includes three indexes -- subject, personal author, and corporate source. Author

N76-21875*# Kanner (Leo) Associates, Redwood City, Calif.
THE ORGANIZATION OF VOLUNTARY MOVEMENT: NEUROPHYSIOLOGICAL MECHANISMS
Ya. M. Kotz Washington NASA Mar. 1976 252 p refs Transl. into ENGLISH of the mono. "Organizatsiya Proizvolnogo Dvizheniya. Neyrofiziologicheskiye Mekhanizmy" Moscow, Nauka Press, 1975 p 1-248
(Contract NASw-2790)
(NASA-TT-F-16871) Avail: NTIS HC $9.00 CSCL 06P

Data from the world's literature on the neurophysiological mechanisms of the organization of voluntary movement in man and the higher animals are correlated in a text (book). Experimental methods are described which were developed for studying the spinal neuronal mechanisms of the organization of voluntary movement and the descending supraspinal control of the segmental motor apparatus in man. The dynamics of complex changes in the state of different neuronal systems of the brain and spinal cord which precede and determine the performance of a voluntary movement are characterized. The role of various supraspinal descending systems in the organization and realization of voluntary movement is analyzed. The textbook is intended for use by physiologists, psychophysiologists, physicians, cybernetic-icists, industrial and sports physiologists, and specialists in aerospace medicine. Author

N76-21876*# Kanner (Leo) Associates, Redwood City, Calif.
STATISTICAL ANALYSIS OF CARDIAC RHYTHM BY MEANS OF HIGHER-ORDER MOMENTS
G. I. Sidorenko, G. K. Afanasyev, and Ya. G. Nikitin Washington NASA Apr. 1976 10 p refs Transl. into ENGLISH from Kardiologiya, v. 15, no. 12, Dec. 1975 p 96-99
(Contract NASw-2790)
(NASA-TT-F-16995) Avail: NTIS HC $3.50 CSCL 06P

A Minsk-22 computer was used for statistical analysis of the rhythm of cardiac contractions. A specialized device -- the intervalmeter -- was developed to measure automatically the intervals between the R spikes of an electrocardiogram and to punch them onto tape for computer input. Analysis of cardiac rhythm consisted in calculating the statistical moments of the first, second, third and fourth order -- the mathematical expectation, dispersion, excess, and asymmetry, in the distribution of R-R intervals in an electrocardiogram. It was found that the use of a statistical moment of the third order -- the index of asymmetry of R-R intervals - reveals the dynamics of transient processes better than an intervalgram. The mathematical moment of the fourth order -- the excess index -- provides an opportunity to evaluate, in a condensed form, the rhythm stability and specifics of its regulation. The use of these methods of cardiac rhythm analysis is expedient for various functional tests and the assessment of pharmacological effects. Author

N76-21877# Research Inst. of National Defence, Stockholm (Sweden).
EMP EFFECTS ON MANKIND
M. Wik Apr. 1975 12 p Transl. into ENGLISH from Swedish Report
(AWRE-Trans-67) Avail: ERDA Depository Libraries HC $4.00

The effects of electromagnetic pulses (EMP) on humans are very much a problem of secondary importance in the context of nuclear explosions. This report is intended to present a basis for the evaluation of EMP effects on man in those cases where such effects can, if at all, be contemplated. The report deals with conceivable causes of the effects, electric shock, and protection against the effects of EMP on man. Author (NSA)

N76-21878# Commission of the European Communities, Luxembourg.
RADIOLOGICAL PROTECTION: 3. TECHNICAL RECOMMENDATIONS FOR THE USE OF THERMOLUMINESCENCE FOR DOSIMETRY IN INDIVIDUAL MONITORING FOR PHOTONS AND ELECTRONS FROM EXTERNAL SOURCES
1975 52 p refs
(EUR-5358e) Avail: ERDA Depository Libraries HC $5.75

The advantages of thermoluminescence dosimetry for monitoring personnel for radiation dosages are discussed. The properties of thermoluminescent detectors and sources of possible errors in thermoluminescent dosimetry are reviewed. (NSA)

N76-21879# Australian Atomic Energy Commission, Coogee.
EFFECTS OF IONIZING RADIATION ON MAN
G. M. Watson Aug. 1975 27 p refs
(AAEC/IP-1) Avail: ERDA Depository Libraries HC $4.50

Major effects of ionizing radiation on man and the relationship between such effects and radiation dose were studied. It was concluded that standards of radiological safety must be based on the carcinogenetic and mutagenic properties of ionizing radiation. Exposure from man-made sources of radiation should be regulated but, since there is little observational or experimental evidence for predicting the effects of the very small doses likely to be required for adequate standards of safety, it is necessary to infer them from what is seen at high doses. Two assumptions are conventionally used: that there is a linear relationship between dose and effect at all levels of dose, and that the rate at which a dose of radiation is given does not alter the magnitude of the effect. These assumptions are thought to be conservative, that is they will not lead to an underestimation of the effects of small radiation doses although they may give an overestimate. Author (NSA)

N76-21880# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
EVALUATION OF FLIGHT FITNESS IN LATENT DIABETES: EFFECTS AND QUALITATIVE DETERMINATION OF ORAL ANTIDIABETIC DRUGS [ZUR BEURTEILUNG DER FLIEGERTAUGLICHKEIT BEI LATENTEM DIABETES: WIRKUNGSWEISE UND QUALITATIVER NACHWEIS DER ORALEN ANTIDIABETICA]
G. Schaefer [1973] 16 p In GERMAN
(DLR-IB-355-73/2) Avail: NTIS HC $3.50

Subclinical diabetic patients under oral antidiabetic treatment should not be recruited nor be retained in flight crews as flight stress could precipitate unpredictable hypoglycemic crises as a drug side effect. Effects of antidiabetic sulfamides and biguanides are discussed. Excretion routes, serum, and urine detection are reviewed. ESA

N76-21881# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.
CARDIAC PACEMAKERS IN AIR TRANSPORTATION [HERZSCHRITTMACHER IM FLUGVERKEHR]
H. Hohlweck [1974] 7 p In GERMAN
(DLR-IB-004-72/4) Avail: NTIS HC $3.50

Two kinds of cardiac pacemakers, acting on demand and permanently regulating the heart contraction, were tested for disturbances from onboard electronics as well as disturbing onboard electronics in suitable test conditions. Passengers wearing a pacemaker should not walk through a high frequency weapon control instrumentation. ESA

N76-21882# Life Sciences, Inc., Hurst, Tex.
TEST OF A MODEL OF VISUAL SPATIAL DISCRIMINATION AND ITS APPLICATION TO HELICOPTER CONTROL Final Report, 1 Jun. 1972 - 31 May 1975
N. A. Crowder, J. A. Bynum, and W. G. Matheny Jun. 1975 55 p refs
(Contract DADA17-72-C-2110)
(AD-A018080; LSI-TR-75-2) Avail: NTIS CSCL 06/16

A series of 4 laboratory studies and 3 field studies using a helicopter in hovering flight were undertaken to validate and test the assumptions made in and the predictions made from the Thielges-Matheny 'Analysis of Visual Discrimination in Helicopter Control'. The results of the field studies generally were in accordance with the predictions made from the model. In particular, certain results suggest that improved hover accuracy is obtained when the pilot is required or otherwise induced to use an eye-line-of-regard depressed substantially below his customary visual scan pattern. The laboratory studies were concerned primarily with validating the assumptions made in the Thielges-Matheny model concerning visual discrimination of changes in angular separation or relationship of two points in

the visual field. The results of the laboratory studies show that the simple Weber ratio is not an adequate index of discriminability of displacement of one point with respect to the other. One of the results, that detection of motion across the imaginary line separating the two points is at least as easy as detection of displacement along that line, allows a considerable simplification of the model without changing its more important predictions. The most striking finding of the laboratory studies is the appearance of an 'Angular shrinkage illusion' which causes the angular separation of two points to be recalled as less than it actually was. GRA

N76-21883# Naval Aerospace Medical Research Lab., Pensacola, Fla.

PULMONARY FUNCTION TESTING IN MILITARY PERSONNEL: A PRELIMINARY STUDY

Robert Bason and David R. Stoop May 1975 17 p refs (MF51524005)

(AD-A018067; NAMRL-1217) Avail: NTIS CSCL 06/16

The military community is made up of a very diverse group of individuals representing a random sample from all walks of life and geographical locations. Although these individuals are supposedly healthy, an increasing number of them are later being diagnosed as having obstructive ventilatory mechanics. This study is concerned with the pulmonary function results of a supposedly healthy population of Naval Aviation Officer Candidates and designated Naval Aviators at Naval Air Station, Pensacola, Florida. The data suggest a high incidence of obstructive ventilatory mechanics in a relatively young age group (20-24 years old). Whereas most studies such as this reflect disease statistics in patients already symptomatic, this current investigation reveals a significant percentage (23.5%) of the as yet asymptomatic young age group who have the beginnings of a long-term process. Author (GRA)

N76-21884# Navy Experimental Diving Unit, Panama City, Fla.

NITROUS OXIDE AND TREMOR Final Report

R. C. Carter, M. K. Mewha, and L. E. Lash 30 Sep. 1975 24 p refs

(AD-A017748; NEDU-10-75) Avail: NTIS CSCL 06/20

Standing steadiness and postural tremor were measured for seven subjects while breathing nitrous oxide. Concentrations of nitrous oxide were twelve, eighteen, twenty-nine, and thirty-four percent. Measurements were also made while subjects breathed pure oxygen and air. Nitrous oxide affected neither frequency spectrum nor magnitude of postural tremor. Standing unsteadiness increased exponentially with nitrous oxide dosage. Subjects tended to correct their balance more often as the concenttration of nitrous oxide was increased. Approximate equivalent dosages of hyperbaric air and nitrous oxide are shown. GRA

N76-21885# Naval Medical Field Research Lab., Camp Lejeune, N.C.

PREDICTING THE RECTAL TEMPERATURE RESPONSE TO HEAT STRESS Medical Research Progress Report

Garold K. Osborn Oct. 1975 19 p refs (MF51524023)

(AD-A016451; NMFRL-Vol-XXV-No-11; PR-1) Avail: NTIS CSCL 06/19

The accuracy of Givoni-Goldman's equations and of the power function equation Y = a(X sup b) for the prediction of rectal temperature was determined for a sample of Marine troops undergoing different levels of heat strain. The equations of Givoni-Goldman, developed to be applied to heat-acclimatized men, were more accurate in their prediction when the observed values of rectal temperature were above rather than below 38.5C. The effect of heat conditioning was to increase the difference between predicted and observed values so that the latter tended to be overestimated. When the rectal temperature-time response curve was projected, by means of the power function equation, to later time points from values measured at three time points early in the exposure, the projected values tended to be lower than observed values for subjects experiencing higher degrees of heat strain. While more than 50% of the differences between observed and projected values were less than 0.5C, yet such individual differences could be as large as 1C. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N76-21886*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PASSENGER RIDE QUALITY WITHIN A NOISE AND VIBRATION ENVIRONMENT

Thomas K. Dempsey, Jack D. Leatherwood, and Arlene B. Drezek (Northrop Services) Apr. 1976 25 p refs

(NASA-TM-X-72841) Avail: NTIS HC $3.50 CSCL 05E

The subjective response to noise and vibration stimuli was studied in a ride quality simulator to determine their importance in the prediction of passenger ride quality. Subjects used category scales to rate noise discomfort, vibration discomfort, both noise and vibration discomfort, and overall discomfort in an effort to evaluate parametric arrangements of noise and vibration. The noise stimuli were composed of octave frequency bands centered at 125, 250, 2,000 and 4,000 Hz, each presented at 70, 75, 80, and 85 dB(A). The vertical vibration stimuli were 5 Hz bandwidth random vibrations centered at 3, 5, 7, and 9 Hz, each presented at 0.03, 0.06, 0.09, and 0.12 grms. Analyses were directed at (1) a determination of the subject's ability to separate noise and vibration as contributors to discomfort, (2) an assessment of the physical characteristics of noise and vibration that are needed for prediction of ride quality in this type of multifactor environment, and (3) an evaluation of the relative contribution of noise and vibration to passenger ride quality. Author

N76-21887# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Hamburg (West Germany). Inst. fuer Flugmedizin.

MINIMUM FLIGHT CREW OF TRANSPORT AIRCRAFT. METHODS FOR MEASURING WORKLOAD OF FLIGHT CREWS

K. Steininger and C. Wistuba [1974] 49 p refs In GERMAN; ENGLISH summary

(Contract BMV-8/73)

(DLR-IB-355-74/3) Avail: NTIS HC $4.00

Objective quantitative estimation of pilots' workload considering the present state of meteorology and knowledge is discussed. Pilot workload is an essential criterion for defining minimum flight crew in civil transport aviation. Best proved methods are selected, including time and motion studies, flight performance and psychological measurements, and measurement of reserve capacity. It is expected that such studies will improve human engineering and operational organization. ESA

N76-21888# Army Aeromedical Research Lab., Fort Rucker, Ala.

PERCEIVED VELOCITY AND ALTITUDE JUDGMENTS DURING ROTARY WING AIRCRAFT FLIGHT Final Report

Richard N. Armstrong, Mark A. Hofman, Michael G. Sanders, Lewis W. Stone, and Charles A. Bowen Sep. 1975 30 p refs

(DA Proj. 3A7-62758-A-819)

(AD-A016870; USAARL-76-3) Avail: NTIS CSCL 05/10

Eight Army rotary wing aviators made judgments concerning the ground speed and altitude of a UH-1 helicopter. Combinations of three ground speeds and four altitudes were used across four visual conditions including daylight and simulated night environments. In general, the results indicate: (1) absolute error in ground speed estimations increased as altitude increased; (2) at ground speeds above 50 knots there was a tendency to underestimate ground speeds, and below 50 knots ground speed estimates were dependent upon visual conditions, (3) absolute error in altitude judgment increases with aircraft altitude; and (4) at low altitudes the trend is toward underestimation and as altitude and airspeed increase the tendency is to overestimate altitude. These and other results are discussed as well as their possible implications for conduct of safe flight. Author (GRA)

N76-21889# Purdue Univ., Lafayette, Ind.

THE EFFECTS OF ROOM SIZE AND GROUP SIZE ON

INDIVIDUAL vs GROUP TASK PERFORMANCE
Glenda Yukie Nogami Apr. 1975 61 p refs
(Contract N00014-67-A-0226-0030; NR Proj. 177-946)
(AD-A018028; TR-25) Avail: NTIS CSCL 05/10

Four and ten person groups of males and females were placed into 70, 40 or 16 square foot rooms. Working either as a group (interacting) or individually (co-acting), they were asked to perform a perceptual task and a problem solving task. The results indicate that there is no difference in problem solving from dense to less dense areas. However, there appear to be mood and attitude differences from dense to less dense conditions, and a sex difference. GRA

N76-21890# Naval Postgraduate School, Monterey, Calif.
TIME-SHARING EFFECTS ON PILOT TRACKING PERFORMANCE M.S. Thesis
John Patrick Kennedy Sep. 1975 47 p refs
(AD-A016378) Avail: NTIS CSCL 05/10

Subjects were required to simultaneously perform a two-dimensional tracking task and respond to a set of lights with toggle switches. Five levels of difficulty and two stimulus presentation rates were involved in the secondary task. The purpose of the experiment was to examine time-sharing performance of experienced military pilots and to investigate differences in performance by pilots of different types of aircraft. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N76-21891*# Environmental Research Associates, Canoga Park, Calif.
EVA SPACE SUIT EVAPORATIVE COOLING/HEATING GLOVE SYSTEM (ECHGS) Final Report
F. A. Coss 5 Feb. 1976 236 p refs
(Contract NAS9-14479)
(NASA-CR-147527; ERA-2.1.4) Avail: NTIS HC $8.00 CSCL 06K

A new astronaut glove, the Evaporative Cooling/Heating Glove System (ECHGS), was designed and developed to allow the handling of objects between -200 F and +200 F. Active heating elements, positioned at each finger pad, provide additional heat to the finger pads from the rest of the finger. A water evaporative cooling system provides cooling by the injection of water to the finger areas and the subsequent direct evaporation to space. Thin, flexible insulation has been developed for the finger areas to limit thermal conductivity. Component and full glove tests have shown that the glove meets and exceeds the requirements to hold a 11/2 inch diameter bar at + or - 200 F for three minutes within comfort limits. The ECHGS is flexible, lightweight and comfortable. Tactility is reasonable and small objects can be identified especially by the fingertips beyond the one half width active elements. Author

N76-21892*# Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Lab.
STUDIES OF HUMAN DYNAMIC SPACE ORIENTATION USING TECHNIQUES OF CONTROL THEORY Final Report, 1964 - 1974
Laurence R. Young 1974 164 p refs
(Grant NGR-22-009-025)
(NASA-CR-146858) Avail: NTIS HC $6.75 CSCL 05E

Studies of human orientation and manual control in high order systems are summarized. Data cover techniques for measuring and altering orientation perception, role of non-visual motion sensors, particularly the vestibular and tactile sensors, use of motion cues in closed loop control of simple stable and unstable systems, and advanced computer controlled display systems. For individual titles, see N76-21893 through N76-21897.

N76-21893* Massachusetts Inst. of Tech., Cambridge.
MANUAL CONTROL
In its Studies of Human Dynamic Space Orientation Using Tech. of Control Theory 1974 p 3-56 refs (For availability see N76-21892 12-54)
CSCL 05E

Man's nonlinear characteristics and his use of control with compatible and incompatible multiple inputs, both visual and vestibular were studied. Experiments were also made with pulse and bang-bang controllers and the effects of sudden changes in control stick mechanical impedance. Closing the loop through the dynamics of the controlled vehicle allowed experiments on the limits of control of unstable vehicles with and without motion cues. The inverted pendulum controlled element, programmed as a self pacing element, was used extensively as a scalar performance index. In addition, the motorbike equations of motion were studied with regard to required human equalization. Abstracts are included for a series of published data on manual control. Author

N76-21894* Massachusetts Inst. of Tech., Cambridge.
DISPLAYS
In its Studies of Human Dynamic Space Orientation Using Tech. of Control Theory 1974 p 57-84 refs (For availability see N76-21892 12-54)
CSCL 05E

An experimental investigation made to determine the depth cue of a head movement perspective and image intensity as a function of depth is summarized. The experiment was based on the use of a hybrid computer generated contact analog visual display in which various perceptual depth cues are included on a two dimensional CRT screen. The system's purpose was to impart information, in an integrated and visually compelling fashion, about the vehicle's position and orientation in space. Results show head movement gives a 40% improvement in depth discrimination when the display is between 40 and 100 cm from the subject; intensity variation resulted in as much improvement as head movement. Author

N76-21895* Massachusetts Inst. of Tech., Cambridge.
SENSORY PERCEPTION
In its Studies of Human Dynamic Space Orientation Using Tech. of Control Theory 1974 p 85-125 refs (For availability see N76-21892 12-54)
CSCL 05E

The effect of motion on the ability of men to perform a variety of control actions was investigated. Special attention was given to experimental and analytical studies of the dynamic characteristics of the otoliths and semicircular canals using a two axis angular motion simulator and a one axis linear motion simulator. Author

N76-21896* Massachusetts Inst. of Tech., Cambridge.
MEDICAL APPLICATIONS
In its Studies of Human Dynamic Space Orientation Using Tech. of Control Theory 1974 p 127-135 refs (For availability see N76-21892 12-54)
CSCL 05E

The application of a hybrid computer CRT display to clinical diagnosis and treatment was investigated. Specifically, pathological limb movement and associated muscular activity was examined. Author

N76-21897* Massachusetts Inst. of Tech., Cambridge.
EQUIPMENT
In its Studies of Human Dynamic Space Orientation Using Tech. of Control Theory 1974 p 137-145 refs (For availability see N76-21892 12-54)
CSCL 05E

A discussion is presented on the problems encountered in designing and constructing a simulator to determine human vestibular response to a range of linear accelerations from 0 to 0.3 g's. Starting with a set of initial performance specifications, the designers combined an array of commercially available components into a system which, altough requiring further refinement before completion, shows considerable promise of fulfilling the initial requirements. The resulting system consists of a wheeled vehicle driven by a cable and drum arrangement,

powered by a hydraulic-electric servo-valve. Technical design considerations are presented along with a discussion of the trade-offs between various component options. A description of the system characteristics as well as an analysis of preliminary test results and recommendations for future system improvements are included. Author

N76-21898# Systems Research Labs., Inc., Dayton, Ohio.
DESIGN OPTION DECISION TREE, A METHOD FOR SYSTEMATIC ANALYSIS OF DESIGN PROBLEMS AND INTEGRATION OF HUMAN FACTORS DATA
W. B. Ackren and Kenneth D. Korkan Brooks AFB, Tex. AFHRL Jul. 1975 21 p refs Paper presented at 18th Ann. Meeting of the Human Factors Soc., Huntsville, Ala., 15-17 Oct. 1974
(Contracts F33615-70-C-1440; F33615-73-C-4044; AF Proj. 1124; AF Proj. 1710)
(AD-A016418; AFHRL-TR-75-9) Avail: NTIS CSCL 05/5

A graphical format termed the Design Option Decision Tree (DODT) is described. The DODT displays the various design options available at each decision point in the design process. Several examples of DODTs for aircraft design problems are illustrated. The procedures for developing a DODT are described. A proposed method for use of the DODT to resolve a design problem is presented. This method includes evaluating the design options in the Tree for impact on the system, and tracing paths through the Tree as dictated by specific design goals. The use of human factors data as one of the evaluation parameters is described. The paper concludes with a discussion of other uses of a DODT. Author (GRA)

N76-21899# National Oceanic and Atmospheric Administration, Rockville, Md. Manned Undersea Science and Technology Office.
INTERNATIONAL REVIEW OF MANNED SUBMERSIBLES AND HABITATS
Joseph R. Vadus Apr. 1975 88 p Presented at the Atlantic Intern. Search and Rescue Seminar, LANTSAR '75, N.Y., 22-25 Apr. 1975
(PB-246428/7; NOAA-75101501) Avail: NTIS HC$5.00 CSCL 13J

A tabulation is presented of the international submersibles (manned and unmanned) and habitats of the world and lists their owner/operators, location, classification, and their physical characteristics and capabilities. The listings include only submersibles that are designed for operation to depths of 600 feet or greater and have been operating recently or can be made ready for sea operations within a few weeks, or those under construction. The United States owns 29 out of the over 70 submersibles available worldwide. The highest incidence of submersible usage is in the North Sea. GRA

N76-21900# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
GUIDE TO THE MANMOD2SSB (MAN-MACHINE MODEL VERSION 2: STEADY STATE, BATCH VERSION), COMPUTER PROGRAM
Jeffrey E. Berliner Jun. 1975 60 p refs
(Contract DAAH01-75-C-0158)
(AD-A017759; RD-CR-76-2) Avail: NTIS CSCL 09/2

The MANMOD2SSB computer program allows separate specification of the 'internal model' and the system model in the optimal control model of the human operator. This guide is the user's manual for the program. GRA

N76-21901# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
LIFE ON AN ICE ISLAND
A. Chilingarov, E. Sarukhanyan, and M. Yevseyev Dec. 1975 209 p Transl. into ENGLISH of the book "Pod Nogami Ostrov Ledianoi" Moscow, 1972 160 p
(AD-A018072; CRREL-TL-502) Avail: NTIS CSCL 05/5

This book was written and compiled by members of a komsomol-youth staff of scientific researchers on the drifting station 'Severnyy Polyus - 19'. Their diaries, notes, log entries, telegrams, autobiographies, interviews with veteran Arctic explorers, photographs and reproductions of various documents are the content of this book. On the way to the North Pole the small youthful crew of the station experienced everything that could happen to man in the Arctic, including faults and cracks, disintegration of the ice and hasty moves from place to place, and encounters with bears. However, the scientific work was not interrupted for even an hour. Author (GRA)

N76-21902# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
ALL DIGITAL SIMULATION FOR MANNED FLIGHT IN TURBULENCE Final Report, Jan. 1974 - Mar. 1975
Joseph J. Pollard Sep. 1975 189 p refs
(AF Proj. 1986)
(AD-A018126; AFFDL-TR-75-82) Avail: NTIS CSCL 05/8

A completely digital simulator for manned flight in conventional aircraft through a turbulent environment is developed. The six-degree-of-freedom constant coefficient linearized perturbation equations of motion are developed for use in conjunction with a generalized stability augmentation system. A six-degree-of-freedom turbulence environment suggest by Mil Spec 8785B is implemented by solving stochastic linear differential equations. A pilot consisting of two parts: (1) a decision making data processor and (2) a physical implementation of the required control action is developed. Concepts such as urgency for action, instrumentation thresholds, pure pilot delay, pilot prediction, pilot lag, and pilot motor noise are treated. The resulting all digital closed loop multi-axis, multi-input, multi-output system is applied to aircraft of various classes including the F-5, A-7, 707, and T-33. Results are presented in tabular and graphical form with statistical tests run to show simulation validity and comparability with actual man-in-the-loop simulations. Additional applications of the digital simulator are made showing its usefulness in the overall concept of aircraft simulation. Author (GRA)

N76-21903# Institute for Organizational Behaviour Research, Lafayette, Ind.
DEVELOPMENT AND EVALUATION OF AN OBJECTIVE TECHNIQUE TO ASSESS EFFORT IN TRAINING Final Report, Nov. 1973 - Apr. 1975
Robert D. Pritchard, John H. Hollenback, and Phillip J. DeLeo Oct. 1975 51 p refs
(Contract F41609-74-C-0010; AF Proj. 1141)
(AD-A017864; AFHRL-TR-75-39) Avail: NTIS CSCL 05/9

The research explored the validation of a quantifiable, objective, and reliable method of measuring the amount of effort to be directly rewarded in incentive systems. A battery of relevant ability tests was given to a sample of Air Force trainees and to civilian subjects using a simulation of the course taught the Air Force trainees. Results showed that the simulation subjects were comparable to the Air Force subjects and that the ability test battery predicted performance equally well for both samples. The hard criterion of effort displayed wide variability, excellent reliability, and good construct validity. GRA

N76-21904# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
MANMOD 1975, HUMAN INTERNAL MODELS AND SCENE-PERCEPTION MODELS
S. Baron and J. E. Berliner Sep. 1975 42 p refs
(Contract DAAH01-75-C-0158; DA Proj. 1M3-62303-A-214)
(AD-A017762; RD-CR-76-3) Avail: NTIS CSCL 05/8

In previous applications of the optimal control model of the human operator it has been assumed that the 'internal model' is an exact replica of the system model. This assumption appears satisfactory in many instances, as has been demonstrated by agreement between model predictions and experimental data. There are situations in which the assumption does not appear tenable. For example, highly complex systems, naive or untrained operators and undetected component failure. This analysis presents methods of implementing an internal model which differs from the system model. GRA

N76-21905# School of Aerospace Medicine, Brooks AFB, Tex.
AIR-FORCE-PREPARED FROZEN MEALS EVALUATED FOR INFLIGHT SERVICE Final Report, May - Oct. 1974
Joseph C. Crigler, John E. VanDerVeen, and Mary A. Sanders Aug. 1975 16 p refs
(AF Proj. 7930)
(AD-A016425; SAM-TR-75-26) Avail: NTIS CSCL 06/8

An operational test was conducted to compare the acceptability of Air-Force-prepared frozen meals with those bought on

contract from a commercial source. Neither type meal was superior when they were compared on the basis of appearance, taste and overall acceptability. Provided the Air Force meals are packaged in containers compatible to aircraft ovens, these meals can be substituted without loss of quality or acceptability.
Author (GRA)

N76-21906# Miami Univ., Oxford, Ohio. Dept. of Psychology.
RESEARCH ON THE RECOGNITION AND ANALYSIS OF COMPLEX AND DYNAMIC IMAGERY
Allan Pantle Wright-Patterson AFB, Ohio AMRL Oct. 1975 63 p refs
(Contract F33615-74-C-4032; AF Proj. 7233)
(AD-A018074; AMRL-TR-75-61) Avail: NTIS CSCL 06/16

Recent literature on visual information processing contains considerable evidence that demonstrates the existence of functionally independent pattern (form) and transient (motion) systems in human vision. Research with complex static imagery and with dynamic imagery was conducted (and is reported herein) for the purpose of elucidating the operation of the pattern and transient systems, respectively. Experiments on the perception of static, real-life scenes were conducted within the framework of the Fourier-analyzer model, a model which states that the spatial frequency components of visual scenes are encoded in separate channels. Priorities for the acquisition of visual information in different spatial frequency ranges were studied in recognition experiments. Complementary research on eye scans was carried out in an effort to develop procedures for correlating eye fixations with the spatial frequency content of local regions of the scenes. The results suggest that relationships between recognition performance, eye scans, and the spatial frequency content of visual scenes can provide a useful basis for characterizing the search strategies of human observers in different kinds of perceptual tasks. GRA

N76-21907# Navy Experimental Diving Unit, Panama City, Fla.
MODIFICATIONS AND TESTING OF MARK 10 MOD 4 CLOSED CIRCUIT BREATHING APPARATUS Final Report
Thomas W. Cetta and R. Radecki Sep. 1975 20 p
(AD-A017750; NEDU-6-75) Avail: NTIS CSCL 06/19

As a result of extreme respiratory difficulty experienced at 1,000 ft., a breathing resistance study was performed to identify the problem area. A breathing resitancy of 22 centimeters of H2O inhale and 48 centimeters of H2O exhale at a depth of 1,000 FSW(feet sea water) using 0.4 PO2 with a breathing rate of 37 breaths per minute was measured. Upon completion of gas passage modifications, the breathing resistance was reduced to 11 cm. H2O exhale at a depth of 1,000 FSW using 0.4 PO2 at a breathing rate of 37 breaths per minute. As a culmination of the tests and modifications, during NAVXDIVINGU's 1,600 ft working dive, breathing resistance was measured on a diver using a Mark 10 Mod 4 as modified, to be 12 cm. inhale and 15 cm. exhale at a breathing rate of 23 breaths per minute.
GRA

N76-21908# Air Force Human Resources Lab., Brooks AFB, Tex.
UNDERGRADUATE PILOT TRAINING TASK MANEUVER TIME STUDY Final Report, Jul. 1973 - Sep. 1974
James E. Brown, J. T. Mullen, and Steven K. Rust Sep. 1975 23 p refs
(AF Proj. 1123)
(AD-A017844; AFHRL-TR-75-42) Avail: NTIS CSCL 05/9

The objective of this study was to determine the time required to perform selected undergraduate pilot training maneuvers in the T-37 and T-38 aircraft. This report describes the method of collecting data and the maneuvers selected for investigation. The data for each maneuver was analyzed to provide maximum and minimum values, means and standard deviations. Implications of the data for syllabus development are presented. GRA

N76-21909# Air Force Human Resources Lab., Brooks AFB, Tex.
ENVIRONMENTAL DATA BASE DEVELOPMENT PROCESS FOR THE ASUPT CIG SYSTEM Final Report
Eric G. Monroe Aug. 1975 67 p
(AF Proj. 1192)
(AD-A017845; AFHRL-TR-75-24) Avail: NTIS CSCL 05/9

This report was prepared under the assumption that the reader has a general understanding of the Advanced Simulator for Undergraduate Pilot Training (ASUPT) Computer Image Generation (CIG) System, at least to the level of that presented in the technical report, Advanced Simulation in Undergraduate Pilot Training (ASUPT) Facility Utilization Plan. Modeling for CIG may be thought of as a new art form in which the features to be modeled are approximated by sets of straight line segments forming planar faces to which a shade of gray is assigned. Basically the data base is structured in the sequence edge, face, object, model, and environment, each item composed of a set of the items immediately preceeding it in the sequence. The detailed definition of each item is transferred from the coding forms prepared by the modeler to computer input cards. These cards serve as the computer source input. The offline software algorithms perform validation checks on this input. Error messages are related through the teletype and line printer. Valid data is stored as libraries of objects, models and environments on magnetic tapes, and the appropriate environment is restored on disc by a media conversion from tape to disc. GRA

N76-21910# Environmental Health Lab., Kelly AFB, Tex.
EVALUATION OF POTABILITY OF WATER COLLECTED/STORED IN SEA SURVIVAL EQUIPMENT Final Report
Richard A. Virost Mar. 1975 31 p refs
(AD-A008188; EHL(K)-75-4) Avail: NTIS CSCL 06/20

Results of three investigations into the potability of water collected/stored in sea survival equipment are reported. Items tested included a rubberbacked nylon life raft canopy, a vinyl-coated nylon signal paulin, and a chloroprene-coated nylon life preserver flotation cell. The effects on potability of all three items were investigated based first on the techniques used to manufacture the item, second, on the storage and use of the item, and third, on a chemical/public health analysis of water that had been in contact with the item for 72 hours. The studies revealed that the canopy did not deleteriously affect the water collected/stored on it. The other studies indicated that both the paulin and the flotation cell would require pretreatment to remove either physically or physiologically objectionable material. Suggestions for pretreatment are included that could be implemented either in the survival situation or preferably before use. GRA

N76-21911# Payne, Inc., Annapolis, Md.
SELECTED TOPICS ON TRACTOR ESCAPE SYSTEMS Final Report, 1 Nov. 1973 - 31 Jan. 1975
Peter R. Payne Jul. 1975 146 p refs
(Contract F33615-74-C-4015; AF Proj. 7231)
(AD-A018073; Working-Paper-119-10; AMRL-TR-75-9) Avail: NTIS CSCL 01/3

In assessing the effectiveness of an extraction escape system, the motion of the crew member as he clears the cockpit is generally more important than his subsequent trajectory, particularly if we are concerned about the possibility of injury due to impact with the local structure, or injury due to limb flailing. The aerodynamic forces (and resulting deformation) of the extraction pendant, and the aerodynamic forces on the crew member, as the emerges from the cockpit, are the most important items, and these are analyzed theoretically in this report. Emerging crew member forces are also measured experimentally, using live human subjects in a wind tunnel simulation of extraction from an aircraft. A new extraction system concept - the ballistic extractor - is also analyzed, in a preliminary way, and is found to offer promise of avoiding the high speed ejection problems of rocket extraction systems. It should also be lighter, less expensive to develop and less expensive to build in quantity.
Author (GRA)

N76-21912# Research Triangle Inst., Research Triangle Park, N.C.
RANN UTILIZATION EXPERIENCE. CASE STUDY NO. 6: INDUSTRIAL SWEETENER SYRUPS
G. T. Isao 1975 30 p refs Prepared by Iowa State Univ. of Sci. and Technol.
(Contract NSF C-927)
(PB-247250/4; NSF/RA/G-75-034) Avail: NTIS HC $4.00 Available also as complete rept. and sum., PB-247243 HC $13.00 CSCL 07A

The development of techniques for applying immobilized enzyme reactions as an improved method for the production of industrial sweetener syrups from cornstarch is discussed. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

N76-21913*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STUDIES RELATED TO THE DEVELOPMENT OF THE VIKING 1975 LABELED RELEASE EXPERIMENT
Donald L. DeVincenzi and Paul H. Deal Washington Apr. 1976 19 p refs
(NASA-TR-R-460; A-6408) Avail: NTIS HC $3.50 CSCL 03B

The labeled release life detection experiment on the Viking 1975 Mars mission is based on the concept that microorganisms will metabolize radioactive organic substrates in a nutrient medium and release radioactive carbon dioxide. Several experiments, using laboratory equipment, were carried out to evaluate various aspects of the concept. Results indicate: (1) label is released by sterilization-treated soil, (2) substantial quantities of label are retained in solution under basic conditions, (3) the substrate used, as well as position of label in the molecule, affect release of label, (4) label release is depressed by radiolytic decomposition of substrates, and (5) About 100,000 organisms are required to produce a detectable response. These results, suggest additional areas for testing, add to the data base for interpretation of flight results, and have significance for broader application of this technique for assessing microbial activity. Author

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N76-21914* National Aeronautics and Space Administration. Pasadena Office, Calif.
SHARED MEMORY FOR A FAULT-TOLERANT COMPUTER Patent
George C. Gilley, inventor (to NASA) (JPL) Issued 13 Apr. 1976 10 p Filed 31 Aug. 1973 Supersedes N74-17911 (12 - 09, p 1026) Sponsored by NASA
(NASA-Case-NPO-13139-1; US-Patent-3,950,729; US-Patent-Appl-SN-393524; US-Patent-Class-340-172.5; US-Patent-Class-235-153AE) Avail: US Patent Office CSCL 09B

A system is described for sharing a memory in a fault-tolerant computer. The memory is under the direct control and monitoring of error detecting and error diagnostic units in the fault-tolerant computer. This computer verifies that data to and from the memory is legally encoded and verifies that words read from the memory at a desired address are, in fact, actually delivered from that desired address. The means are provided for a second processor, which is independent of the direct control and monitoring of the error checking and diagnostic units of the fault-tolerant computer, and to share the memory of the fault-tolerant computer. Circuitry is included to verify that: (1) the processor has properly accessed a desired memory location in the memory; (2) a data word read-out from the memory is properly coded; and (3) no inactive memory was erroneously outputting data onto the shared memory bus.
Official Gazette of the U.S. Patent Office

N76-21915*# SCI Systems, Inc., Huntsville, Ala.
DATA MANAGEMENT SYSTEM CIU AND DIU. APPENDIX A: CIU AND DIU SCHEMATICS Final Technical Report
Oct. 1975 317 p
(Contract NAS8-29155)
(NASA-CR-144052) Avail: NTIS HC $9.75 CSCL 09B

The Computer Interface Unit (CIU) and the Data Interface Unit (DIU) of the Data Management System (DMS) were described as to their functional location, purpose and function. This describes the CIU and DIU at the unit level illustrating their interface thru the Data Bus (DBUS) and to other DMS units. All unit level interfaces are defined as to function and characteristics. The controls, indicators, test points and connectors are listed and function, location and application are described for each. The mechanical configuration is defined and illustrated to provide card and component location for modification or repair purposes. Unique disassembly and assembly requirements are outlined where applicable. A unit internal functional block diagram level description is provided. Author

N76-21916*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A MICROPROCESSOR CONTROLLED PRESSURE SCANNING SYSTEM
Robert C. Anderson 1976 13 p Presented at Aerospace/Test Meas. Symp., San Diego, Calif., 25-27 May 1976; sponsored by Instr. Soc. of Am.
(NASA-TM-X-71886; E-8665) Avail: NTIS HC $3.50 CSCL 09B

A microprocessor-based controller and data logger for pressure scanning systems is described. The microcomputer positions and manages data from as many as four 48-port electro-mechanical pressure scanners. The maximum scanning rate is 80 pressure measurements per second (20 ports per second on each of four scanners). The system features on-line calibration, position-directed data storage, and once-per-scan display in engineering units of data from a selected port. The system is designed to be interfaced to a facility computer through a shared memory. System hardware and software are described. Factors affecting measurement error in this type of system are also discussed.
Author

N76-21917# National Aviation Facilities Experimental Center, Atlantic City, N.J.
RELIABILITY ANALYSIS OF THE 9020A AND 9020D CENTRAL COMPUTER COMPLEX AT THE NATIONAL AVIATION FACILITIES EXPERIMENTAL CENTER Final Report, Jun. 1966 - Sep. 1972
Arthur R. Moss Nov. 1975 69 p refs
(AD-A020160; FAA-NA-75-37; FAA-RD-75-175) Avail: NTIS HC $4.50 CSCL 09/2

The reliability of the 9020A and 9020D versions of the central computer complex was assessed for periods of 3 and 1 years, respectively. This reliability was expressed in terms of the mean uptime (MUT), mean downtime (MDT), and mean time between failures (MTBF) of two system modes (A1 and C1) made up of the same subsystems but containing different numbers of operating and redundant elements in the subsystems. The 9020A was subjected to a 1-year official reliability test. Results indicate the MUT and MTBF for the A1 mode exceeded the contractual requirements by factors of 14.6 and 4.5 or greater, respectively. The corresponding factors for the C1 mode were 4.14 and 6.15 or greater respectively. The MDT for each mode was within the specified limit. Reliability assessment on the 9020A was continued for an additional 2 years following the completion of the official 1-year test period. Results show that the MUT and MTBF for both 9020A modes, over the combined 3 years of assessment, still greatly exceeded the contractual requirements. The MDT of the A1 mode was within the specified 60-minute maximum; however, the MDT of the C1 mode (39

minutes) exceeded the specified 30-minute maximum. The 9020D, an improved version of the 9020A, was also assessed for a 1-year period. Author

N76-21918# Intertechnique S. A., Plaisir (France). Dept. Telemesure.
SELFREPAIRING SEMICONDUCTOR MEMORIES. PART 1: INTRODUCTION [MEMOIRES AUTOREPARABLES A SEMICONDUCTEURS. TOME 1: PRESENTATION]
25 Jun. 1975 21 p In FRENCH Prepared jointly with Microelectronic-Lewicki 5 Vol.
(Contract ESTEC-2119/73-HP)
(D6/DB/FB/1771/A-Pt-1; ESA-CR(P)-747-Pt-1) Avail: NTIS HC $3.50

A feasibility study of high capacity and highly reliable selfrepairing semiconductor memories is presented. The concept of selfrepair is dealt with and the choice of components is discussed. (A static 256 bit memory in complementary MOS technology, Philips-RTC GZF 1106, and a dynamic 1024 bit memory in MOS channel P technology, 1404, various American manufacturers, were chosen.) The parametric study is outlined and conditioning of the memory is dealt with. ESA

N76-21919# Intertechnique S. A., Plaisir (France). Dept. Telemesure.
SELFREPAIRING SEMICONDUCTOR MEMORIES. PART 3: PARAMETRIC STUDY [MEMOIRES AUTOREPARABLES A SEMICONDUCTEURS. TOME 3: ETUDE PARAMETRIQUE]
Jun. 1975 138 p In FRENCH Prepared jointly with Microelectronic-Lewicki 5 Vol.
(Contract ESTEC-2119/73-HP)
(D6/DB/FB/1378/B-Pt-3; ESA-CR(P)-794-Pt-3) Avail: NTIS HC $6.00

Evaluations of the Philips 256 bit static memory in C.MOS technology and the S.G.S. 1024 bit dynamic memory in P.MOS technology were made. For each of the two memories the study was carried out using checking logic with standard components (type C.MOS RCA) and checking logic of the optionally monolithic circuit type. The extensive feasibility calculations made, the establishment of the feasibility formula, the corresponding programs, and the feasibility calculations of memories without selfrepairing systems are annexed. ESA

N76-21920# Intertechnique S. A., Plaisir (France). Dept. Telemesure.
SELFREPAIRING SEMICONDUCTOR MEMORIES. PART 4: DETAILED SYSTEM STUDY [MEMOIRES AUTOREPARABLES A SEMICONDUCTEURS. TOME 4: ETUDE DETAILLEE DU SYSTEME]
Jun. 1975 103 p In FRENCH Prepared jointly with Microelectronic-Lewicki 5 Vol.
(Contract ESTEC-2119/73-HP)
(D6/DB/FB/1769/A-Pt-4; ESA-CR(P)-750-Pt-4) Avail: NTIS HC $5.50

The circuits which would allow the realization of selfrepairing memories were defined. For the two memories used (Philips C.MOS static memory and S.G.S. dynamic P.MOS memory), the different modules (basic element, checking logic, elementary board, module for elimination of elementary boards and configuration logic) were studied in detail. A final feasibility analysis was made and the power consumption was evaluated at 250 mW at 10 kHz and 25 mW at 1 kHz for the static 1 Mbit memory and 3 W at 1 kHz, 7 W at 10 kHz, and 11.2 W at 20 kHz for the dynamic 1 Mbit memory. ESA

N76-21921# Intertechnique S. A., Plaisir (France).
SELFREPAIRING SEMICONDUCTOR MEMORIES. PART 5: TECHNOLOGICAL CONDITIONING STUDY [MEMOIRES AUTOREPARABLES A SEMICONDUCTEURS. TOME 5: ETUDE TECHNOLOGIQUE DU CONDITIONNEMENT]
Oct. 1975 186 p refs Partly in ENGLISH and FRENCH Prepared jointly with Intertechnique S.A. 5 Vol.
(Contracts ESTEC-2119/73-HP; D6/GB/NO-1675)
(D6/DB/PP/1770/A-P7-5; ESA-CR(P)-751-P7-5) Avail: NTIS HC $7.50

Hybrid technology was studied: a survey of semiconductor components mounting and packaging technologies; semiconductor components (packaging types, handling, test); optimization of substrate complexity and packaging concept; selected thick film process; and a proposal for an optimized advanced semiconductor memory. Finally the substrate conditioning is dealt with in brief. ESA

N76-21922# Research Inst. of National Defence, Stockholm (Sweden).
ERROR MESSAGES IN 360-ALGOL, 360/370 SIMULA, DEC 10 ALGOL AND DEC 10 SIMULA
Hakan Odemalm and Jacob Palme Oct. 1975 57 p refs
(PB-247308/0; FOA-P-C-8364-M3(E5)) Avail: NTIS HC $4.50 CSCL 09B

Thirty eight test programs, most of them containing errors, were run on three ALGOL compilers: The IBM 360-ALGOL F compiler, The IBM 360/370 Simula 67 compiler and the DEC system 10 ALGOL compiler. Interesting differences were found between the compilers, and the result should be of interest especially for someone designing the error checking facility in a compiler for an ALGOL-like language. None of the three tested compilers was markedly better than the other, since when one compiler was good for some errors, then another was better for other errors. DEC 10 Simula has been added in the second edition of the report. GRA

N76-21923# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE COMPUTER LEARNS TO TALK
Sergei Ivanov 19 Nov. 1975 11 p Transl. into ENGLISH from Rabochaya Gazeta (USSR), no. 208, 5 Sep. 1975 4 p
(AD-A017927; FTD-ID(RS)I-2306-75) Avail: NTIS CSCL 09/2

Specialists of various countries who are working on the problem of artificial intellect see in it the basis for the solution of problems quite common for the present day, for example the optimization of the construction of living space or clinical treatment. Man communicates with the computer in the artificial language of algorithms. 'Automatic recognition of speech' is the theme of the work of one of eleven sections of the International Conference on Artificial Intellect which began 3 Sept. in Tbilisi. 'Communication with computers in a natural language' is the topic of another conference. Here the author is talking about communication in a printed form. GRA

N76-21924# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
IMAGE ANALYSIS AND MODELING Quarterly Technical Report, 1 Feb. 1975 - 30 Apr. 1975
Paul A. Wintz and T. S. Huang Aug. 1975 198 p refs
(Contract F30602-75-C-0150; ARPA Order 2893)
(AD-A017765; RADC-TR-75-202) Avail: NTIS CSCL 09/2

The objective of the research is to achieve a better understanding of image structure and to use this knowledge to develop improved models for use in image analysis and processing tasks such as information extraction, image enhancement and restoration, coding, etc. The ultimate objective of this research is to form a basis for the development of technology relevant to military applications of machine extraction of information from aircraft and satellite imagery of the earth's surface. This report discusses research activities during the three month period February 1 - April 30, 1975. GRA

N76-21925# Bendix Research Labs., Southfield, Mich.
IMAGE-IMAGE CORRELATOR ADVANCED CONCEPTS Final Technical Report, Feb. 1974 - Jun. 1975
James O. Abshier Sep. 1975 111 p
(Contract F30602-74-C-0151; AF Proj. 5569)
(AD-A017764; BRL-7764; RADC-TR-75-226) Avail: NTIS CSCL 09/2

Photographic imagery is converted to video signals which can be processed by computer and control equipment. Electronic signal processing offers great flexibility, but is limited by the amount of imagery that can be processed at any one time. Optical techniques can handle much larger areas of imagery but it is difficult to derive and apply the control signals required to process this imagery. The recent application of epipolar scanning of stereophotographs in the AS-11B-X stereomapper has permitted faster sensing and processing of photographic imagery. This system uses an electronic correlator for processing. A system

design concept was developed using parallel-channel coherent-optical image-image correlation techniques to extract terrain elevation data from aerial photographs. The speed of the correlator is only about one-fourth that possible with the present AS-11B-X system. Compared to the AS-11B-X system, the image-image optical correlator is also less capable of handling variations in photographic imagery characteristics. GRA

N76-21926# Federal COBOL Compiler Testing Service, Washington, D.C.
UNIVAC 1100 UNI ANSI/ASCII VERSION 2.4H EXEC 8 LEVEL 27.225/A11 Final Validation Summary Report
4 Dec. 1975 46 p
(AD-A018197; CCVS68-VSR125) Avail: NTIS CSCL 09/2

This Validation Summary Report (VSR) provides a consolidated summary of the results obtained from the validation of the subject compiler. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies by Federal level module; a section relating the categories of discrepancies to each of the Federal levels of the language; and a detailed listing of discrepancies together with the tests which were failed. GRA

N76-21927# Automatic Data Processing Equipment Selection Office (Navy), Washington, D.C. Software Development Div.
COBOL COMPILER VALIDATION SYSTEM, 1974. VERSION 1.0: IMPLEMENTATION DOCUMENTATION, VOLUME 14
Nov. 1975 90 p
(AD-A017940; USN-CCVS-74-Vol-14;
DOD/DF-75/002A-Vol-14) Avail: NTIS CSCL 09/2

This document represents the implementation information necessary to implement the 1974 U.S. Navy COBOL Compiler Validation System (CCVS). The 1974 CCVS will consist of audit routines, their related data, and an executive routine (VP-Routine) which prepares the audit routine for compilation. Each audit routine is a COBOL program which includes many tests and supporting procedures indicating the result of the tests. The audit routines collectively contain all of the features of American National Standard Programming Language COBOL - X3.23-1974 (except for the ENTER statement of the Nucleus module) as specified in Federal Information Processing Standard (FIPS) 21-1. GRA

N76-21928# Mitre Corp., Bedford, Mass.
THE STANDARD MUX BUS: SOME CONSTRAINTS ON INFORMATION FLOW ARISING FROM MIL-STD-1553 (USAF)
P. R. Cloud Nov. 1975 45 p refs
(Contract F19628-75-C-0001; AF Proj. 6370)
(AD-A017677; MTR-3041) Avail: NTIS CSCL 09/1

MITRE has designed, constructed, and operated an avionics time division multiplex bus compatible with the requirements of MIL-STD-1553 (USAF). In the course of engineering the software to perform the message control function for this network, some constraints on the message flow were encountered that are not immediately apparent when reading the standard. The purpose of this report is to alert the system designer to some of these potential difficulties. Four main topics are discussed: (1) Bus capacity; (2) A time constraint on message handling; (3) Subaddresses, and Data Word accessibility; and (4) Temporal characteristics of information transferred on the bus. GRA

N76-21929# RAND Corp., Santa Monica, Calif.
COMPUTERS AND STRATEGIC ADVANTAGE. 3: GAMES, COMPUTER TECHNOLOGY, AND A STRATEGIC POWER RATIO
E. W. Paxson May 1975 50 p
(Contract F44620-73-C-0011)
(AD-A017755; R-1644-1-PR) Avail: NTIS CSCL 09/2

This is one of a series of reports that examine the nature and impact of U.S. computer technology relative to that of the Soviet Union, and the military advantages that the United States may be able to achieve through applications of advanced computer technology. This particular report presents a model for measuring the cost to both sides to realize in the future various U.S. to S.U. strategic power ratios, in terms of the percentages of strategic forces that would need to be modernized, given different relative military technology levels. A numerical run of the model shows that increases in the Soviet growth rate in computer technology beyond the historical rate can have significant implications for the required modernization of U.S. forces if a desired strategic power ratio is to be maintained. GRA

N76-21930# Research Inst. of National Defence, Stockholm (Sweden).
A CODASYL-TYPE DBMS SYSTEM IN SIMULA
Kalle Makila Aug. 1975 35 p refs
(PB-246999/7; FOA-1-C-10038-M3(E5)) Avail: NTIS HC $4.00 CSCL 09B

A CODASYL type Data Base Management system (DBMS) has been written entirely in SIMULA. The system is called SIMDBM. SIMDBM is fully usable in itself for data bases of moderate size. It is especially suitable for education about data base management, because of its simplicity and clarity. The system is also an investigation into how an interface can be arranged between the SIMULA programming language and a DBMS system. There is a need both for a general purpose interface, where the SIMULA program without change can handle an data base, and a special purpose interface generated for a specific application, in which data base RECORDS are directly mapped onto corresponding SIMULA CLASS objects. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N76-21931*# Science Applications, Inc., Huntsville, Ala.
SSL: A SOFTWARE SPECIFICATION LANGUAGE
Sandra L. Austin, Billy P. Buckles, and J. Patrick Ryan 26 Jan. 1976 74 p refs
(Contract NAS8-31379)
(NASA-CR-144236; SAI-77-537-HU) Avail: NTIS HC $4.50 CSCL 09B

SSL (Software Specification Language) is a new formalism for the definition of specifications for software systems. The language provides a linear format for the representation of the information normally displayed in a two-dimensional module inter-dependency diagram. In comparing SSL to FORTRAN or ALGOL, it is found to be largely complementary to the algorithmic (procedural) languages. SSL is capable of representing explicitly module interconnections and global data flow, information which is deeply imbedded in the algorithmic languages. On the other hand, SSL is not designed to depict the control flow within modules. The SSL level of software design explicitly depicts intermodule data flow as a functional specification. Author

N76-21932*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOFTWARE HANDLERS FOR PROCESS INTERFACES
Robert W. Bercaw 1976 15 p refs Presented at Symp. on Autom. Computation and Control, Milwaukee, 22-24 Apr. 1976; sponsored by the Inst. of Elec. and Electron. Engr. and Assoc. for Computing Machinery
(NASA-TM-X-71908; E-8702) Avail: NTIS HC $3.50 CSCL 09B

Process interfaces are developed in an effort to reduce the time, effort, and money required to install computer systems. Probably the chief obstacle to the achievement of these goals lies in the problem of developing software handlers having the same degree of generality and modularity as the hardware. The problem of combining the advantages of modular instrumentation with those of modern multitask operating systems has not been completely solved, but there are a number of promising developments. The essential principles involved are considered. Author

N76-21933# Atlantic Richfield Hanford Co., Richland, Wash.
ALLCUTS: A FAST, COMPREHENSIVE FAULT TREE ANALYSIS CODE
W. J. VanSlyke and D. E. Griffing Jul. 1975 133 p refs
(Contract E(45-1)-2130)

(ARH-ST-112) Avail: NTIS HC $5.75

A description, user instructions, and a source program listing are presented for ALLCUTS, a FORTRAN computer code for fault tree analysis. The code was specifically designed to be easy to use as well as fast, versatile, and powerful. It may easily be modified by a moderately skilled programer to fit the variable needs of the user and the capabilities of his computer. A code, BRANCH, for determining input data gate and bottom event interrelationships is also presented. Author (NSA)

N76-21934# Naval Postgraduate School, Monterey, Calif.
HIGH-LEVEL LANGUAGE COMPILING FOR USER-DEFINABLE ARCHITECTURES
Donald Carlton Simoneaux Jun. 1975 77 p refs
(AD-A017648) Avail: NTIS CSCL 09/2

The development of large-scale integrated circuits in the last few years has resulted in a rapid increase in the number of digital devices available for electronic system design. Skilled system designers often do not have an abundance of software experience and require better tools than are presently available in order to take maximum advantage of microprocessors and other functional building blocks. A case is made for the development of a highlevel language compiler which will allow the designer to specify not only his algorithm but also his hardware configuration and his optimization constraints. The PL/M compiler developed by Intel Corporation is used as a model for examining some of the requirements of this machine-independent compiler. A summary of work which was done to implement the first stages of such a compiler is presented, and factors which must be considered in order to further this work are discussed. Author (GRA)

N76-21935# Stanford Univ., Calif. Digital Systems Lab.
CORRECTNESS CONDITION GRAPHS
Clifford R. Hollander Sep. 1975 18 p refs Sponsored in part by Army
(Contract N00014-67-A-0112-0044; AF Proj. 7163)
(AD-A017859; TN-52) Avail: NTIS CSCL 09/2

A graphical, syntax-oriented method for computing and representing correctness conditions is proposed. For each (flowchart) program, a directed graph is generated which explicitly displays the structure and interrelationships among the antecedent, consequent, and verification conditions for its statements. The mapping of programs onto condition graphs is formally defined by augmenting the productions in a flowchart grammar with subgraph constructors. The goal is to give the programmer deeper insight into the semantics of his program, thereby facilitating his (possibly interactive) formulation of the assertions needed to carry out its verification. GRA

N76-21936# Stanford Univ., Calif. Digital Systems Lab.
CONSTRUCTION OF PRIMITIVES FOR A MULTIPROCESS ENVIRONMENT
Clifford R. Hollander Aug. 1975 24 p refs Sponsored in part by the Army
(Contract N00014-67-A-0112-0044; AF Proj. 6961)
(AD-A017808; TN-63) Avail: NTIS CSCL 09/2

In a multiprocess environment, an operation is said to be primitive if it is guaranteed to execute atomically, in the sense that it is not subject to interference or interruption from other operations. The concern of this paper is not with the selection of an appropriate set of primitives, but rather with the mechanism(s) by which the atomicity they require can be realized. The methodology of the Vienna Definition Language (VDL) is exploited to obtain a formal description of such a primitive former. A conceptual implementation of Dijkstra's P-V semaphore operations serves as a case study in exercising the primitive former to properly control interprocess concurrency. GRA

N76-21937# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
ALL THE FACETS OF ZERO-ONE PROGRAMMING POLYTOPES WITH POSITIVE COEFFICIENTS
Egon Balas and Eitan Zemel Oct. 1975 25 p refs
(Contract N00014-75-C-0621; Grant NSF MPS-73-08534)
(AD-A018189; RR-374) Avail: NTIS CSCL 12/2

The authors give a linear characterization of 0-1 programming polytopes with positive coefficients, by showing that every non-trival facet of such a polytope can be obtained from a minimal cover for P, or for a polytope obtained from P by complementing some of the variables, via a generalized facet lifting procedure. GRA

N76-21938# Harvard Univ., Cambridge, Mass. Computation Lab.
A RECURSIVE ANALYSIS OF DISSECTION STRATEGIES Technical Report, Jun. 1974 - Oct. 1975
Donald J. Rose and Gregory F. Whitten Nov. 1975 30 p refs
(Contract N00014-75-C-0245; NR Proj. 044-454)
(AD-A018138; TR-24-75) Avail: NTIS CSCL 12/1

A formalism for analyzing 'structurally recursive' (or 'divide and conquer') algorithms is developed, and give some examples of such algorithms in numerical algebra. In particular we analyze in detail nested dissection strategies for ordering sparse matrices arising from NXM grids in the plane. We then turn to issues of implementation and describe a software package for completely solving such sparse systems efficiently, paying particular attention to minimizing the list processing overhead. Author (GRA)

N76-21939# Texas Univ., Austin. Center for Cybernetic Studies.
IMPROVED BOUNDS FOR A CLASS OF 0-1 INTEGER PROGRAMS USING COMBINED SURROGATE-LAGRANGEAN TECHNIQUES
Fred Glover (Colo. Univ., Boulder) and G. Terry Ross Jun. 1975 25 p refs
(Contracts N00014-75-C-0616; N00014-75-C-0569; NR Proj. 047-021)
(AD-A017936; CCS-241) Avail: NTIS CSCL 12/2

A new method is described for calculating bounds for a special class of 0-1 integer programming problems. This method includes features of both Lagrangean and surrogate relaxation approaches. Certain binary knapsack calculations carried out in appropriate combinations together with an additivity principle provide the basis for computing the bounds. GRA

N76-21940# Texas Univ., Austin. Center for Cybernetic Studies.
A LINKED LIST DATA STRUCTURE FOR A BINARY KNAPSACK ALGORITHM
Richard S. Barr and G. Terry Ross Aug. 1975 30 p refs
(Contracts N00014-75-C-0616; N00014-75-C-0569; NR Proj. 047-021)
(AD-A017934; CCS-232) Avail: NTIS CSCL 12/2

This paper describes a novel application for a linked list in Greenberg's and Hegerich's algorithm for the binary knapsack problem. This list accelerates the solution of the problem by providing an efficient method for solving linear programming relaxations of the problem. Computational testing on 400 randomly generated problems with up to 7,500 variables is reported. For these problems, average solution times increase linearly with problem size when the linked list is used. The effectiveness of various problem reduction schemes is also explored. GRA

N76-21941# Massachusetts Inst. of Tech., Cambridge. Operations Research Center.
IMPLEMENTING VEHICLE ROUTING ALGORITHMS
Bruce L. Golden, Thomas L. Magnanti, and Hien Q. Nguyen Sep. 1975 52 p refs
(Contracts N00014-75-C-0556; DAHC04-73-C-0032; NR Proj. 347-027)
(AD-A018020; TR-115) Avail: NTIS CSCL 12/2

Heuristic programming algorithms frequently address large problems and require manipulation and operation on massive data sets. The algorithms can be improved by using efficient data structures. With this in mind, we consider heuristic algorithms for vehicle routing, comparing techniques of Clarke and Wright, Gillett and Miller, and Tyagi, and presenting modifications and extensions which permit problems involving hundreds of demand points to be solved in a matter of seconds. In addition, a multi-depot routing algorithm is developed. The results are illustrated with a routing study for an urban newspaper with an evening circulation exceeding 100,000. Author (GRA)

N76-21942# IBM Federal Systems Center, Gaithersburg, Md.
STRUCTURED PROGRAMMING SERIES. VOLUME 2: PRECOMPILER SPECIFICATIONS Final Technical Report
Nathan Tinanoff 9 May 1975 159 p refs
(Contract F30602-74-C-0186; AF Proj. 5550)
(AD-A018046; RADC-TR-74-300-Vol-2) Avail: NTIS CSCL 09/2

This report contains a description of, and program specifications for implementation of the structured programming standards in 'Programming Language Standards,' Volume I of the Structured Programming Series. Specifications are presented for precompiler or macro processing programs for the ANS COBOL, ANS FORTRAN, JOVIAL J3, JOVIAL J73, and TACPOL compilers, and the AN/GYK-12 and IBM S/360 Assemblers. The precompiler or macro processing programs are designed to process four structured programming figures (IFTHENELSE, DOWHILE, DOUNTIL, and CASE). The INCLUDE capability which facilitates top down programming is also addressed. GRA

N76-21943# Mitre Corp., Bedford, Mass.
A RANDOM WORK GENERATOR FOR PRONOUNCEABLE PASSWORDS
M. Gasser Nov. 1975 182 p refs
(Contract F19628-75-C-0001; AF Proj. 522N)
(AD-A017676; MTR-3006; ESD-TR-75-97) Avail: NTIS CSCL 09/2

The random word generator is a PL/I program designed to run on Honeywell's Multics system that generates random pronounceable words suitable for use as passwords for Multics users. Author (GRA)

N76-21944# IBM Federal Systems Center, Gaithersburg, Md.
STRUCTURED PROGRAMMING SERIES. VOLUME 12: TRAINING MATERIALS Final Report
Marvin M. Kessler 15 Jul. 1975 114 p refs
(Contract F30602-74-C-0186; AF Proj. 5550)
(AD-A018084; RADC-TR-74-300-Vol-12) Avail: NTIS CSCL 09/2

These training materials were used as the basis for the four presentations made as part of Task 12 of the Structured Programming Series contract. Volume XII of the Structured Programming Series contains only the course outline. The pages which are missing are the viewgraphs to be used in presenting the course. The hard copies of approximately 400 viewgraphs are not included because of the enormous printing cost involved and because many recipients might not have any use for them. Therefore, only those organizations having a valid need for them will receive a set by responding to RADC (ISIS/Donald L. Mark), Griffiss AFB NY 13441. It is requested this office receive written justification not later than 1 February 1976 so that the quantity to be published may be determined.
Author (GRA)

N76-21945# IBM Federal Systems Div., Cape Canaveral, Fla.
DESIGN OF TRAINING SYSTEMS: PROGRAM MAINTENANCE MANUAL DATA BASE, ETE, SCRR, AND TPF MODELS. FOCUS ON THE TRAINED MAN
Harold J. Bellamy, Kenneth V. Branch, James D. Staley, and Ronald E. Yanko Sep. 1975 616 p refs
(Contract F61330-73-C-0097)
(AD-A018089; TAEG-29) Avail: NTIS CSCL 05/9

The report contains detailed information on the three Design of Training Systems (DOTS) models and the DOTS data base. It consists of a single volume containing a description and macro flow, detailed logic flows and program listings for the Educational Technology Evaluation model (ETE), the System Capabilities Requirements and Resources (SCRR) model, the Training Process Flow (TPF) model and the DOTS data base. Control logic, input/output record formats, and temporary and permanent data files are described for each subsystem (the three models and the data base). The information contained in this volume is intended for use by programmers tasked with installing or modifying the DOTS programs. GRA

N76-21946# IBM Federal Systems Div., Cape Canaveral, Fla.
DESIGN OF TRAINING SYSTEMS, USER'S MANUAL, DATA BASE, ETE, SCRR, AND TPE MODELS
Harold J. Bellamy, Kenneth V. Branch, James D. Staley, and Ronald E. Yanko Sep. 1975 315 p refs
(Contract N61339-73-C-0097)
(AD-A018012; TAEG-30) Avail: NTIS CSCL 05/9

The purpose of this User's Manual is to familiarize the non-ADP user of the Design of Training Systems (DOTS) programs with the operation of the three DOTS models and the DOTS data base. It is concerned with methods for using the DOTS programs without detailed treatment of the design rationale or specified programming techniques employed in developing the models and the data base. The design of the system components is covered in detail in Volumes I and II of TAEG Report 12-2, 'Design of Training Systems Phase II Report.' Detailed programming information is contained in TAEG Report No. 29, 'The Design of Training Systems Program Maintenance Manual.' This manual is organized in four major sections covering the DOTS data base, the Educational Technology Evaluation (ETE) model, the System Capabilities Requirements and Resources (SCRR) model and the Training Process Flow (TPF) model respectively. The sections dealing with the models are all organized similarly and include subsections on model architecture, operational procedures and operational test. The model architecture section describes the model for the user in terms of model functions, significant design assumptions, input data requirements and output data descriptions. Operational procedures are covered as they relate specifically to the individual models and contain the steps necessary to apply the models to appropriate problems. Operational tests are specified to the extent necessary to assess system functional integrity but do not cover tests to determine the validity of the system in specific applications.
GRA

N76-21947# IBM Federal Systems Div., Gaithersburg, Md.
STRUCTURED PROGRAMMING SERIES. VOLUME 7: DOCUMENTATION STANDARDS, ADDENDUM Final Technical Report
Martha S. Bennett, Samual W. Hughes, Louis H. Ortega, and Wayne H. Richards 15 Apr. 1975 115 p refs Cosponsored by the Army 15 Vol.
(Contract F30602-74-C-0186; AF Proj. 5550)
(AD-A016414; RADC-TR-74-300-Vol-7-Add) Avail: NTIS CSCL 09/2

This report is an addendum to Documentation Standards Final Report, Volume 7 of the Structured Programming Series. This report presents the results of a study to determine the impact of structured programming technology on Army documentation standards. Changes are recommended to AR 18-1 and USACSC Manuals 18-1 and 18-100 to permit their use by projects using both traditional structured programming development methods. Author (GRA)

N76-21948# IBM Federal Systems Div., Gaithersburg, Md.
STRUCTURED PROGRAMMING SERIES. VOLUME 8: PROGRAM DESIGN STUDY Final Technical Report
Thomas M. Kraly, John J. Naughton, Ronald L. Smith, and Nathan Tinanoff 30 May 1975 72 p refs Cosponsored by the Army 15 Vol.
(Contract F30602-74-C-0186; AF Proj. 5550)
(AD-A016415; RADC-TR-74-300-Vol-8) Avail: NTIS CSCL 09/2

This volume reports on program design tools and techniques. It evaluates these tools and techniques determining their relationship to structured programming technology and presents their advantages and disadvantages. The major conclusion of this report is that program design languages, as well as detailed flowcharts, facilitate expression of program control flow but the former is more easily produced and maintained at less expense. Author (GRA)

N76-21949# IBM Federal Systems Div., Gaithersburg, Md.
STRUCTURED PROGRAMMING SERIES. VOLUME 11: ESTIMATING SOFTWARE PROJECT RESOURCE REQUIREMENTS Final Technical Report
Ronald L. Smith 22 Jan. 1975 70 p refs Cosponsored by the Army 15 Vol.
(Contract F30602-74-C-0186; AF Proj. 5550)
(AD-A016416; RADC-TR-74-300-Vol-11) Avail: NTIS CSCL 09/2

This report contains an analysis of techniques currently used

for estimating software resource requirements and addresses the effect structured programming technology will have on these techniques. Techniques addressed cover all phases of software development - definition, design, implementation, and evaluation. Author (GRA)

N76-21950# National Bureau of Standards, Washington, D.C.
AIDS FOR COBOL PROGRAM CONVERSION (FIPS PUB 21 TO FIPS PUB 21-1) Federal Information Processing Standards
Mabel V. Vickers 1 Dec. 1975 58 p refs
(PB-247653/9; FIPS-PUB-43) Avail: NTIS HC $4.50 CSCL 09B

Since COBOL is a living language, in the sense that it is under constant development and clarification, the federal community which relies heavily on COBOL to satisfy programming needs has a large degree of assurance that COBOL will continue to meet their needs as future generation systems are introduced. However, along with the advantage of having more sophisticated and better COBOL tools to meet new systems requirements, there is a short term disadvantage. As clarifications and new facilities are added, they interact with the language specifications already standardized, and this interaction sometimes requires changes in source programs. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N76-21951# Freiburg Univ. (West Germany). Inst. fuer Physik.
A COMPUTER WITH THE PROBLEM-ORIENTED MACHINE LANGUAGE BASIC [EIN RECHNER MIT DER PROBLEMORIENTIERTEN MASCHINENSPRACHE BASIC]
H. J. Buerkle Mar. 1974 120 p refs In GERMAN
(Rept-C-29) Avail: NTIS HC $5.50

The development of a small minicomputer which directly interprets the BASIC programming language is described. It is shown that a hardware interpretation is at least equivalent to a compiling method with respect to run time. Necessary and effective functional units for such a high level machine language are reviewed. In view of automation of the design of higher programming language hardware interpreters, an effort was made to formalize the semantics of programming languages using an interpretation method discussed. ESA

N76-21952# Freiburg Univ. (West Germany). Inst. fuer Physik.
A COMPUTER WITH THE PROBLEM-ORIENTED MACHINE LANGUAGE BASIC [EIN RECHNER MIT PROBLEMORIENTIERTER MASCHINENSPRACHE BASIC]
A. Frick Mar. 1974 148 p refs In GERMAN
(Rept-C-30) Avail: NTIS HC $6.00

A dialog language-oriented computer was designed using BASIC as a machine language. Formal aids for an implementation-oriented representation of BASIC are dealt with. A suitable memory and register structure are proposed. The semantics of the formal notation were translated into circuits using some basic components. The computer run time was estimated as a function of the components. ESA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N76-21953*# Houston Univ., Tex. Dept. of Mathematics.
SOME RESULTS ON CONTRACTIVE MAPPINGS AS RELATED TO PATTERN RECOGNITION
Dennison R. Brown and Matthew J. Malley Oct. 1975 20 p refs
(Contract NAS9-12777)
(NASA-CR-147519; Rept-49) Avail: NTIS HC $3.50 CSCL 09B

Several of the techniques used in pattern recognition are reformulated as the problem of determining fixed points of a function. If x sub 0 is a fixed point of f and if f is contractive at x sub 0, then, for any y belonging to a sufficiently small neighborhood of x sub 0 the orbit of y will converge to x sub 0. Several general results regarding contractive mappings are developed with emphasis on functions. Author

N76-21954*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPACE SHUTTLE POGO ACTIVE CONTROLLER DESIGN USING FREQUENCY DOMAIN OPTIMIZATION
Robert C. Seidel, Carl F. Lorenzo, and Bruce Lehtinen Washington Apr. 1976 40 p refs
(NASA-TM-X-3368; E-8529) Avail: NTIS HC $4.00 CSCL 22B

A frequency domain parameter optimization technique was used to design active pogo suppression controls for the space shuttle. The technique uses a conjugate gradient search procedure and is well suited for designing low-order controllers for higher order systems. The shuttle model was a two-pump and six-structural-mode linear model representing a worst-case condition. A promising feedback controller structure was found to be a lead-lag design. Author

N76-21955# Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn (West Germany).
DEFINABILITY OF EQUATIONS IN RELATIONAL STRUCTURES [GLEICHUNGSDEFINIERBARKEIT IN RELATIONALSTRUKTUREN]
Klaus Indermark (Bonn Univ.) 1975 52 p refs In GERMAN Sponsored in part by Bundesmin. fuer Forsch. u. Technol. and Landesamt fuer Forsch. of Nordrhein-Westfalen
(BMFT-GMD-98) Avail: NTIS HC $4.50; Ges. fuer Math. und Datenverarbeitung DM 7

The fundamentals of a calculability theory of random structures are presented, where calculability is reduced to a family of effective relationship operators and to the solution of equation systems. The fixed point theorem of Tarski was proven suitable for the treatment of such equation systems. ESA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N76-21956# Bettis Atomic Power Lab., West Mifflin, Pa.
SOLUTION OF LINEAR EQUATIONS RESULTING FROM FINITE ELEMENT DISCRETIZATIONS OF MULTIDIMENSIONAL BOUNDARY VALUE PROBLEMS
L. A. Hageman Aug. 1975 61 p refs
(Contract E(36-1)-GEN-14)
(WAPD-TM-1209) Avail: NTIS HC $6.25

Direct rather than iterative methods are usually used to solve the large system of equations resulting from finite element discretizations of multidimensional boundary value problems. This preference for the direct method of solution, while not without justification, has progressed to the point where iterative solution methods are considered as passe to some. The initial results of a study are summarized to determine if iterative methods are no longer competitive with direct solution methods. It is concluded that iterative methods continue to possess potential as a practical tool and are probably necessary if detailed three-dimensional problems are to be solved in the future. Author (NSA)

N76-21957# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
EIGENVALUES OF THE DISCRETE ORDINATES EQUATIONS IN SLAB GEOMETRY
I. J. Donnelly Sep. 1975 23 p refs
(AAEC/E-360) Avail: ERDA Depository Libraries HC $4.25

The discrete ordinates approximation of the one-group, source-free, neutron transport equation was solved analytically for slab geometry. The resulting eigenvalues are functions of

both the angular quadrature and the spatial mesh used in the discrete ordinates equations. The dependence of the eigenvalues on the angular quadrature was examined for three limiting cases. Both the diamond difference and step function approximations were considered in the evaluation of the eigenvalue dependence on the spatial mesh size. Author (NSA)

N76-21958# Harvard Univ., Cambridge, Mass. Aiken Computation Lab.
SPARSE MATRIX PROBLEMS IN A FINITE ELEMENT OPEN OCEAN MODEL Technical Report, Jun. 1974 - Oct. 1975
Joel E. Hirsh and William L. Briggs Nov. 1975 23 p refs Submitted for publication
(Contract N00014-75-C-0243; NR Proj. 044-454)
(AD-A018137; TR-23-75) Avail: NTIS CSCL 12/1

A finite element method is given to solve the quasigeostrophic equations in an open-sided domain. The complicating features of the problem are the non-linearity of the equations and the time dependence of the boundary conditions. The problem is first posed in full generality, and its difficulties are discussed. Simplifications are then considered which restrict the physical model to gain computational efficiency. The end result of this reduction process is a model which is computationally feasible, but still physically meaningful. Author (GRA)

N76-21959# Kent State Univ., Ohio. Dept. of Mathematics.
ON CONVERGENCE OF THE SYMMETRICAL RELAXATION PROCESS Interim Report
G. Alefeld (Karlsruhe Univ.) and R. S. Varga 1975 10 p refs In GERMAN; ENGLISH summary
(Contract E(11-1)-2075; Grant AF-AFOSR-2729-74; AF Proj. 9749)
(AD-A017843; AFOSR-75-1513TR) Avail: NTIS CSCL 12/1

For the iterative solution of the matrix equation Ax = b by means of the (point) symmetric SOR method (called the SSOR method), the basic convergence analysis of this iterative process has been developed in the literature only for the case when A is Hermitian and positive definite. With the help of the theory of regular splitting, a more general convergence analysis of this iterative method is obtained, under the weaker assumption that A is a nonsingular H-matrix. Author

N76-21960# State Univ. of New York at Buffalo, Amherst. Statistical Science Div.
COMPARISON OF ESTIMATION PROCEDURES FOR FIRST ORDER MOVING AVERAGE MULTIPLE TIME SERIES
Berbardo Cass Hamer, III Aug. 1975 151 p refs
(Contract N00014-72-C-0508; NR Proj. 042-234)
(AD-A018171; TR-32) Avail: NTIS CSCL 12/1

This dissertation provides an empirical examination of four estimation procedures associated with the estimation of the matrix parameters for a vector moving average process. An important role in this examination is the development of the relationships between the parametric representation for both the vector autoregressive and moving average schemes. This leads to the examination, comparison and utilization of autoregressive order determination and fitting criteria. Spectral plotting and non-linear numerical techniques are also employed. A comparison of the estimation procedures is provided based upon both theoretical and practical criterion. GRA

N76-21961# State Univ. of New York at Buffalo, Amherst. Statistical Science Div.
ON FITTING DISTRIBUTED LAG MODELS SUBJECT TO POLYNOMIAL RESTRICTIONS
Marcello Pagano and Michael J. Hartley Jul. 1975 55 p refs
(Contract N00014-72-C-0508)
(AD-A018165; TR-22) Avail: NTIS CSCL 12/1

A widely used model for relating a time series (TY) to a series (XT) is the linear model, where the z's are independent variables and the (Epsilon t) is a noise series. Fitting this model by least squares one may run into a multicollinearity problem because of the form of the design matrix. Alternatively, one can argue that nature acts smoothly. In either case, one can constrain the (beta J) to lie on a lower dimensional space. Methods are presented for estimating the parameters of the system, including the integer parameters, lambda and p, when the noise is white and when the noise may be modeled as an autoregression. These methods are applied to the data analyzed by Almon to show that qualitatively different results are obtained, depending on the model used for the noise series. Author

N76-21962# Wisconsin Univ., Madison. Mathematics Research Center.
A COMBINATORIAL SUM
Richard Askey and Mourad E.-H. Ismail Jul. 1975 15 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-A017926; MRC-TSR-1557) Avail: NTIS CSCL 12/1

Mathematical identities involving binomial coefficients were established as part of a general program aimed at showing that a unified way of establishing identities is to reduce them to a study of hypergeometric functions. An identity derived by this approach is given. Author

N76-21963# Wisconsin Univ., Madison. Mathematics Research Center.
A SINGULAR SEMILINEAR EQUATION IN (L SUPERSCRIPT 1) (R)
Michael G. Crandall and Lawrence C. Evans Sep. 1975 21 p refs
(Contract DAAG29-75-C-0024)
(AD-A017925; MRC-TSR-1566) Avail: NTIS CSCL 12/1

Let beta be a positive and nondecreasing function on IR. The boundary value problem beta(u) - u' = f, u'(plus or minus infinity) = 0 is considered for f epsilon L1(IR). It is shown that this problem can have a solution only if beta is integrable near negative infinity, and that if this is the case, then the problem has a solution exactly when f(x)dx> the definite integral f(x) between the limits infinity and negative infinity. Author

N76-21964# Wisconsin Univ., Madison. Mathematics Research Center.
ON LOCAL LINEAR FUNCTIONALS WHICH VANISH AT ALL B-SPLINES BUT ONE Technical Summary Report
Carl DeBoor Oct. 1975 31 p refs
(Contract DAAG29-75-C-0024)
(AD-A018007; MRC-TSR-1599) Avail: NTIS CSCL 12/1

Starting with a sequence of B-spline of order k for a knot sequence, linear functional are constructed demonstrating the linear independence over an interval of all B-spline which do not vanish identically on that interval. Results obtainable with the aid of these functionals are discussed. Author

N76-21965# Wisconsin Univ., Madison. Mathematics Research Center.
AN EXTENSION OF CARLITZ'S BIPARTITION IDENTITY Technical Summary Report
George E. Andrews Sep. 1975 16 p refs
(Contract DAAG29-75-C-0024; Grant NSF G-23774)
(AD-A018006; MRC-TSR-1587) Avail: NTIS CSCL 12/1

Carlitz's bipartition identity is extended to a multipartite partition identity by the introduction of the summatory maximum function: smax(NL, N1, N2, ... NR) = N1 + N2 + ... + NR - (r-1)min(N1, N2, ... NR). Let pi0(N1, N2, ... NR) denote the number of partitions of (N1, N2, ... NR) in which the minimum coordinate of each part is not less than the summatory maximum of the next part. Let pi1(N1, N2, ..., NR) denote the number of partitions of (N1, N2, ..., NR) in which each part has one of the 2r-1 forms: (a+1, a, a, ..., a), (a, a+1, a, ..., a), ..., (a, a, a, ..., a+1), (ra+2, ra+2, ..., ra+2), (ra+3, ra+3, ..., ra+3), ..., (ra+r, ra+r, ..., ra+r). Theorem: pi0(N1, ..., NR) = pi1(N1, ..., NR). Author

N76-21966# Wisconsin Univ., Madison. Mathematics Research Center.
PERMUTATION PROBLEMS AND SPECIALS FUNCTIONS Technical Summary Report
Richard Askey and Mourad E. H. Ismail Oct. 1975 41 p refs
(Contract DAAG29-75-C-0024; Grant NSF GP-33897)
(AD-A018005; MRC-TSR-1574) Avail: NTIS CSCL 12/1

Integral representations for some combinatorial numbers are established and a combinatorial interpretation is found for certain sums involving the Meixner polynomials. Various integrals of products of Laguerre polynomials are interpreted in a combinatorial way by means of MacMahon's Master Theorem. GRA

N76-21967# Wisconsin Univ., Madison. Mathematics Research Center.
THE k SIMULTANEOUS MEASUREMENT PROCEDURES: A BAYESIAN APPROACH Technical Summary Report
Norman Draper and Irwin Guttman Aug. 1975 21 p refs
(Contracts DAAG29-75-C-0024; N00014-75-C-0562)
(AD-A018004; MRC-TSR-1573) Avail: NTIS CSCL 12/1

When several instruments are used to measure an observed response the accuracy depends on the variance of the distribution of responses and of instrument errors. The problem considered in this paper is estimation of these variances and of certain ratios called relative precisions. The authors adopt a Bayesian approach in attacking the problem and apply a prior distribution to the parameters, proposed by Jeffreys, to obtain the relevant posterior distributions. To illustrate the applicability of these results, some data on burning times of fuses used in projectile firings is analyzed to yield point and interval estimates of the parameters of interest. Areas in which this research might be applied are those in which accuracy and relative precision play an important role, (e.g. instrumentation) rather than those in which substantial variability is present (e.g. agricultural trials) but a comparison of mean values is the main concern. Author (GRA)

N76-21968# Wisconsin Univ., Madison. Mathematics Research Center.
THE LANDAU PROBLEM FOR MOTIONS IN A RING AND IN BOUNDED CONTINUA Technical Summary Report
I. J. Schoenberg Oct. 1975 43 p refs
(Contract DAAG29-75-C-0024)
(AD-A018000; MRC-TSR-1563) Avail: NTIS CSCL 12/1

Landau's theorem, the norm of f infinity < or = 1 and the norm of f' infinity < or = 8 on the real t-axis implies the norm of f' infinity < or = 4, is generalized to motions in a ring r < or = the absolute value of z < or = 1. A study was made of problems arising when: the ring K sub r is replaced by a given bounded continuum K in the complex plane, and the first assumption of the norm of f infinity < or = 1 is replaced by the condition that f(t) epsilon R sup m, and that the range of values of (f)t is contained in a preassigned bounded continuum in R sup m. GRA

N76-21969# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
A MINIMAX FACILITY LOCATION PROBLEM AND THE CARDINALITY CONSTRAINED SET COVERING PROBLEM
Nicos Christofides Oct. 1975 24 p refs
(Contract N00014-75-C-0621)
(AD-A018113; RR-375; WP-23-75-76) Avail: NTIS CSCL 12/2

Given n demand points with weights (W sub i), an integer number k and a critical distance lambda, the problem discussed in the paper is one of choosing the location of k centers so that the total weight of demand points that lie within distance lambda from at least one center is maximized. This minimax location problem reduces to a cardinality constrained set covering problem (CCP), and for this latter problem a hybrid tree-search/dynamic programming algorithm is given. The dynamic program plays two roles: (1) it provides dominance tests to eliminate tree branchings and (2) the concavity properties associated with it can be used in a projection method to provide upper bounds for the nodes in the tree search. GRA

N76-21970# Stanford Univ., Calif. Dept. of Computer Science.
APPLICATIONS OF PATH COMPRESSION ON BALANCED TREES
Robert E. Tarjan Aug. 1975 53 p refs
(Grant NSF DCR-72-03752)
(PB-247895/6; SU-STAN-CS-75-512) Avail: NTIS HC $4.50 CSCL 12A

A method for computing functions defined on paths in trees is devised. The method is based on tree manipulation techniques first used for efficiently representing equivalence relations. The method is applied to give O(m alpha(m,n)) algorithms for two problems: (1) verifying a minimum spanning tree in an undirected graph; (2) finding dominators in a directed graph. Here n is the number of vertices and m the number of edges in the problem graph, and alpha (m,n) is a very slowly growing function which is related to a functional inverse of Ackermann's function. The method is also useful for solving, in O(m alpha(m,n) time, certain kinds of pathfinding problems on reducible graphs. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N76-21971*# Kanner (Leo) Associates, Redwood City, Calif.
ON A GENERAL FORM OF THE PDF AND ITS APPLICATION
A. Plucinska Washington NASA Apr. 1976 19 p refs Transl. into ENGLISH from Zastosowan. Mat. (Poland), v. 9, 1966 p 9-19
(Contract NASw-2790)
(NASA-TT-F-16998) Avail: NTIS HC $3.50 CSCL 12A

The function (2) was constructed for purposes of describing populations obtained from a division of normal populations into parts. The function (2) is a generalization of some known probability density functions. Certain parameter values yield known distributions, as e.g. the Gamma, Chi, Chi-square, exponential, Weibull, normal, and Maxwell distributions. A non-complicated method of estimating the parameters of function (2) on the basis of empirical data is indicated. An example is also given of testing the goodness of fit of the distribution of rheostat resistance and a suitable function of type (2). Author

N76-21972# Center for Naval Analyses, Arlington, Va. Systems Evaluation Group.
TARGET TRACKING: UNIFORMLY DIRECTED MOTION FROM A NORMALLY DISTRIBUTED POSITION
Peter J. Butterly Sep. 1975 23 p refs
(Contract N00014-76-C-0001)
(AD-A018070; CRC-285) Avail: NTIS CSCL 12/1

Following observations of a target position, a set of probabilities, or a position density function, is obtained. If no further information is available, the corresponding probabilities or density function, after a time interval of arbitrary duration, are obtained from the initial probabilities, and an assumed distribution of target course and speed. Point by point computation of the final position probabilities is always possible, but such a procedure is inefficient where all of the distributions may be specified by means of a few parameters. In this case, a preferred approach is to derive the form of the final position density and compute the values of the parameters necessary for a complete specification from the values of the parameters of the initial position density and the assumed distribution of course and speed. In this research contribution, the initial position density is bivariate normal. It is assumed that the distribution of target speed may be approximated by a discrete distribution and that the distribution of target course is independent of speed and uniform on the interval 0 to 2 pi. It is shown that the final position density is expressible as an infinite series of Modified Bessel Functions and that a formal similarity with a well-documented density could be utilized in the computation of its values. Author (GRA)

N76-21973# State Univ. of New York at Buffalo, Amherst. Statistical Science Div.
THE EFFICIENT ESTIMATION OF STATIONARY MULTIPLE TIME SERIES MIXED MODELS, THEORY AND ALGORITHMS
Howard Joseph Newton Aug. 1975 129 p refs
(Contract N00014-72-C-0508; NR Proj. 042-234)
(AD-A018172; TR-33) Avail: NTIS CSCL 12/1

The d-dimensional vector mixed autoregressive moving average time series model plays an important role in the statistical analysis of a wide variety of scientific data, including work in the physical, social, economic, and medical sciences. The statistical theory of the mixed model has been developed in some detail for d = 1. The corresponding theory for multidimensional mixed time series is presently being developed by various authors, with many problems left to be solved. The aim of this thesis is to contribute to this developing theory. It provides a systematic presentation of the algebraic relationships between

various parametrizations of the mixed scheme, and extends some of the results for d = 1 to the case d > 1. Further consideration is the theory of estimation of the parameters of pure autoregressive and moving average processes, as well as the mixed process. Of particular interest are (1) the derivation of the information matrices of the parameters of a mixed process, (2) an extension of the Parzen-Clevenson method of estimating the autocovariances of a scalar moving average process to the multiple case, and (3) two algorithms for determining if a multiple autoregressive process is stationary. GRA

N76-21974# Army Materiel Command, Texarkana, Tex. Intern Training Center.
A COMPARISON OF BAYESIAN RELIABILITY DEMONSTRATIONS Final Report
James Bernard Vogel Apr. 1975 51 p refs
(AD-A009292; USAMC-ITC-02-08-75-104) Avail: NTIS CSCL 14/4

This paper reviews current Bayesian reliability procedures for possible use in development testing. The major concerns are that the test be short, require a minimum of test data, and use the data in an effective manner. An example of this test is given for a piece of equipment whose time to failure is exponentially distributed and is from a population of equipment whose mean time between failure is distributed according to an inverted-gamma distribution. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N76-21975*# Scientific Translation Service, Santa Barbara, Calif.
ON CERTAIN PROBLEMS CONNECTED WITH A DIVISION OF A NORMAL POPULATION INTO PARTS
A. Plucinska Washington NASA Apr. 1976 13 p refs Transl. into ENGLISH from Zastosowan. Mat. (Poland), v. 8, 1965 p 117-125
(Contract NASw-2791)
(NASA-TT-F-16988) Avail: NTIS HC $3.50 CSCL 12B

Elements of mass production are often divided into classes according to the different accuracy of the characteristic features of those elements. A formula is presented which makes it convenient to characterize a population arising from a normal population by cutting out the center symmetrically. Author

N76-21976*# Kanner (Leo) Associates, Redwood City, Calif.
RELIABILITY OF A COMPOUND SYSTEM UNDER CONSIDERATION OF THE SYSTEM ELEMENTS PRICES
A. Plucinska Washington NASA Apr. 1976 20 p refs Transl. into ENGLISH from Zastosowan. Mat. (Poland), v. 9, no. 2, 1967 p 123-134
(Contract NASw-2790)
(NASA-TT-F-16989) Avail: NTIS HC $3.50 CSCL 12B

Consideration is given to the economical and mathematical problem of selecting the N elements of a given system in such a way that the whole system be of maximum reliability and under the condition that the sum of the costs of the N elements is given and constant. One assumes that the characteristic Xi of the elements of the system under consideration is for all i = 1,2,...,N a random variable expressed by a density function, and that the random variables Xi are independent. Various symmetry conditions of the function Y = g(X1, X2, ..., XN), which informs about the global behavior of all N elements of the system, are considered. Author

N76-21977# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.
A FREQUENCY DOMAIN APPROACH TO THE DESIGN OF SAMPLING RATE FOR SYSTEM IDENTIFICATION
Robert L. Payne, Graham C. Goodwin, and Martin B. Zarrop Mar. 1974 9 p refs
(Publ-74/24) Avail: NTIS HC $3.50

The problem of joint determination of input spectra and sampling rate for linear system identification was studied. The concept of an input spectrum preserving sampler is introduced and it is shown that, for this sampler, the usual anti-aliasing filter is optimal and that joint optimal design of input spectrum resampling filter and sampling rate may be readily performed in the frequency domain. Author (ESA)

N76-21978# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
INFINITE HORIZON DYNAMIC PROGRAMMING MODELS: A PLANNING HORIZON FORMULATION
Thomas E. Morton Aug. 1975 41 p refs
(AD-A018188; RR-372; WP-5-75-76) Avail: NTIS CSCL 12/2

Two major research areas in dynamic programming are the proper optimality criteria for infinite horizon models with divergent costs, and conditions under which planning horizon procedures can be effective. The author provides a formal framework for both problems by extending the regeneration set machinery developed by Lundin and Morton for the dynamic lot size model. The discussion is limited to discrete time models. GRA

N76-21979# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
THE VALUE FUNCTION OF A MIXED INTEGER PROGRAM, 1
R. G. Jeroslow Oct. 1975 41 p refs
(Contract N00014-75-C-0621; Grant NSF GP-37510; NR Proj. 047-048)
(AD-A018111; RR-377) Avail: NTIS CSCL 12/2

The function G(b) = inf/cx+dy vertical bar Ax+By = b,x,y greater than or equal 0 and x integer/under the assumptions that G(0) = 0 and A and B are matrices of rationals. G is defined for b epsilon r sub m feasible, i.e., b for which the constraining conditions are consistent. Author

N76-21980# Texas Univ., Austin. Center for Cybernetic Studies.
NETWORK APPLICATION IN INDUSTRY AND GOVERNMENT
Fred Glover (Colo. Univ., Boulder) and Darwin Klingman Sep. 1975 50 p refs
(Contract N00123-74-C-2272; NR Proj. 047-021)
(AD-A017938; CCS-247) Avail: NTIS CSCL 12/2

The primary purpose of this paper is to provide the practicioner with a short, but informative handbook of tools to use in modeling decision making situations as network flow problems. These tools are presented as part of the discussion of recent industrial and governmental applications. The intent is not to enumerate all applications of networks, but rather to give the reader a flavor of the versatility and usability of networks. An additional objective is to acquaint the reader with the process of visualizing a problem by means of network diagrams, thereby making it possible to capture important interrelationships in an easily understood 'pictorial' framework. GRA

N76-21981# Texas Univ., Austin. Center for Cybernetic Studies.
CAPSULE VIEW OF FUTURE DEVELOPMENTS ON LARGE SCALE NETWORK AND NETWORK-RELATED PROBLEMS
Fred Glover (Colo. Univ., Boulder) and Darwin Klingman Jun. 1975 55 p refs
(Contract N00123-74-C-2272; NR Proj. 047-021)
(AD-A017935; CCS-238) Avail: NTIS CSCL 12/2

The primary purpose of this paper is to identify recent major accomplishments and prophesy (suggest) future trends in the solution, modeling, and human engineering aspects of network and network-related problems. In particular, the suggested future trends consist of an integrated sequence of modeling, theoretical and computational developments which may allow mathematical programming to attain its envisioned goal of being a major vehicle for solving pressing industrial and world problems. GRA

N76-21982# Massachusetts Inst. of Tech., Cambridge. Operations Research Center.
OPTIMIZATION FOR SPARSE SYSTEMS
Thomas L. Magnanti Nov. 1975 36 p refs Presented at the Symp. on Sparse Matrix Computations, Ill., 9-11 Sep. 1975
(Contracts N00014-75-C-0556; DAHC04-73-C-0032; NR Proj. 347-027)

(AD-A018018; TR-119) Avail: NTIS CSCL 12/2

Sparse matrices with special structure arise in almost every application of large scale optimization. In linear programming, these problems usually are solved by pivoting procedures, most notably the simplex method, refined and modified in various ways to exploit structure. More recently iterative relaxation methods and dual ascent algorithms have been proposed for certain applications. In surveying several algorithms from each of these categories, this paper demonstrates the potential for investigating and applying sparse system techniques in optimization. Author (GRA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N76-21983# Imperial Coll. of Science and Technology, London (England).

ON A GENERALISATION OF A THEOREM OF LYAPUNOV

G. F. Bryant Apr. 1974 8 p refs

(Publ-74/30) Avail: NTIS HC $3.50

A constructive and simple proof is given of the theorem on the convexity of the range of vector measure. ESA

N76-21984# Imperial Coll. of Science and Technology, London (England). Dept. of Computing and Control.

CANONICAL FORMS FOR THE IDENTIFICATION OF LINEAR MULTIVARIABLE SYSTEMS

M. J. Denham Apr. 1974 21 p refs Sponsored by Sci. Res. Council

(Publ-74/31) Avail: NTIS HC $3.50

An identification algorithm for a linear multivariable system was derived. The definitions necessary for an accurate description of canonical forms were established, including the basic concept of a canonical form. The definitions were applied to the equivalence classes of minimal realizations of transfer function matrices. Several canonical forms are described and the implications of determining those from the Hankel matrix of the system (the minimal realization problem) are discussed. The problem of non-uniqueness in the identification of stochastic systems was resolved by determining a set of canonical forms for the equivalence classes of stable, minimum phase factors of the spectral density matrix phi(z) of a discrete time system. Finally, some of the implications of using canonical forms in identification algorithms are discussed, including the consistency of the estimated parameters. ESA

N76-21985# Texas Univ., Austin. Center for Cybernetic Studies.

CONSTRUCTIVE PROOFS OF THEOREMS RELATING TO: F(x) = y WITH APPLICATIONS

A. Charnes, C. B. Garcia (Chicago Univ.), and C. E. Lemke (Rensselaer Polytech. Inst.) Aug. 1975 30 p refs

(Contract N00014-75-C-0569; Grant NSF MPS-75-09433; NR Proj. 047-021)

(AD-A017939; CCS-248) Avail: NTIS CSCL 12/1

Some theorems are given which relate to approximating and establishing the existence of solutions to systems F(x) = y of n equations in n unknowns, for various y, in a region of euclidean n-space. They generalize known theorems. Viewing complementarity problems and fixed point problems as examples, known results or generalizations of known results are obtained. Author

N76-21986# Wisconsin Univ., Madison. Mathematics Research Center.

VARIATIONAL METHODS AND MONOTONICITY Technical Summary Report

L. Tartar Oct. 1975 77 p refs

(Contract DAAG29-75-C-0024)

(AD-A018003; MRC-TSR-1571) Avail: NTIS CSCL 12/1

Nonlinear equations and variational inequalities in reflexive Banach spaces are considered using the concept of pseudomonotone operators of H. Brezis. The existence theory is based on finite dimensional approximations (solved by using Brouwer fixed point theorem) and a limiting procedure requiring weak continuity properties. Some continuous dependence properties are given and applied to the penalization method. Then some examples are studied (corresponding to heat diffusion). Finally some results on Hammerstein equations are derived. GRA

N76-21987# Wisconsin Univ., Madison. Mathematics Research Center.

THE SEARCH FOR GOOD LATTICE POINTS IN N DIMENSIONS Technical Summary Report

G. Kedem Oct. 1975 22 p refs

(Contract DAAG29-75-C-0024)

(AD-A018002; MRC-TSR-1570) Avail: NTIS CSCL 12/1

A method for the numerical integration of a function f(X) = f(X1,...,XS) over the s-dimensional unit interval consists of choosing a modulus m and an s-dimensional lattice point in order to form the approximation of the true value of the integral, where the coordinates of the point k m/1 q are reduced modulo 1. When m and q are well chosen, bounds for the integration error depend only weakly on the number of dimensions. Author

N76-21988# Wisconsin Univ., Madison. Mathematics Research Center.

NONLINEAR EVOLUTION EQUATIONS IN BANACH SPACES Technical Summary Report

Lawrence C. Evans Aug. 1975 100 p refs

(Contract DAAG29-75-C-0024)

(AD-A018001; MRC-TSR-1568) Avail: NTIS CSCL 12/1

The evolution equation is studied by means of finite difference approximations. It was proved that the solutions to the equations converge to a continuous function whenever the A(t) are m-accretive a.e. and the matrix A(t)x - A(s)x< or = the matrix h(t) - h(s) L(x), h integrable. The results may be applied to the study of nonlinear, time-dependent partial differential equations of evolution. Examples of this type are given. Author

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N76-21989*# Oregon Graduate Center for Study and Research, Beaverton.

FABRICATION AND SURFACE CHARACTERIZATION OF COMPOSITE REFRACTORY COMPOUNDS SUITABLE FOR THERMIONIC CONVERTERS

L. W. Swanson, J. T. Dickinson, and D. R. McNeely Washington NASA Apr. 1976 41 p refs

(Grant NsG-3054)

(NASA-CR-2668) Avail: NTIS HC $4.00 CSCL 20L

Procedures for fabricating high purity single crystals of LaB6 and SmB6 have been developed. Auger spectroscopy shows that a clean surface can be obtained by thermal heating at 1700 K; such a clean surface gives a value of B/La of 2.3 to 2.6 for the (100) face. The measured thermionic and FERP work functions of the (100) face of LaB6 are 2.47 and 2.28 eV, respectively. The electron reflection coefficient for LaB6(100) increases near zero primary energy to 0.5. Flash thermal desorption of an oxygen dosed surface showed that B2O3 is the desorption product at 1600 to 1700 K. A work function increase of 1.6 eV was observed on oxygen adsorption on LaB6(100). Thermal desorption of Co occurs at approximately 1300 K. A reduction of the work function to 1.39 eV was observed on adsorption of a partial monolayer of Cs on LaB6(100). The evaporation of LaB6 occurs as atomic La and B with a value of B/La of 6 to 3 in the temperature range 1700 to 2000 K. The activation energies of desorption for La and B are 6.3 + or - 0.3 and 6.8 + or - 0.3 eV, respectively. Author

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N76-21990*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOURCES AND CHARACTERISTICS OF INTERIOR NOISE IN GENERAL AVIATION AIRCRAFT
John J. Catherines and Sunil K. Jha (Cranfield Inst. of Technol., England) Apr. 1976 24 p refs Presented at 91st Meeting Acoust. Soc. Am., Washington, D. C., 5-9 Apr. 1976
(NASA-TM-X-72839) Avail: NTIS HC $3.50 CSCL 20A

A field study was conducted to examine the interior noise characteristics of a general aviation aircraft. The goals were to identify the major noise sources and their relative contribution and to establish the noise transmission paths and their relative importance. Tests were performed on an aircraft operating under stationary conditions on the ground. Results show that the interior noise level of light aircraft is dominated by broadband, low frequencies (below 1,000 Hz). Both the propeller and the engine are dominant sources, however, the contribution from the propeller is significantly more than the engine at its fundamental blade passage frequency. The data suggest that the airborne path is more dominant than the structure-borne path in the transmission of broadband, low frequency noise which apparently results from the exhaust. Author

N76-21991# Stanford Research Inst., Menlo Park, Calif.
A COMPUTER CODE TO CALCULATE THE EFFECT OF INTERNAL WAVES ON ACOUSTIC PROPAGATION
Stanley M. Flatte and Frederick D. Tappert Mar. 1975 70 p refs
(Contract DAHC15-73-C-0370; ARPA Order 2504; SRI Proj. 3000)
(AD-A016629; SRI-JRS-74-3) Avail: NTIS CSCL 20/1

The signal received by a hydrophone in the ocean many kilometers from a steady sound source fluctuates dramatically due to variations of the speed of sound in sea-water. A computer code that simulates the passage of acoustic CW signals through an ocean with internal waves is written. The code generates a sound-speed field from an internal-wave spectrum that has been derived from oceanographic measurements. The acoustic propagation is achieved through the use of the parabolic-equation approximation. The code is limited fundamentally to acoustic frequencies above approximately 10 Hz, and by practical computer-time constraints to frequencies below approximately 400 Hz. The code allows the calculation of the amplitude and phase of the full acoustic field as a function of depth and range at any desired time. Author (GRA)

N76-21992# Argonne National Lab., Ill.
SOUND PROPAGATION IN NORMAL AND SUPERFLUID 3He
J. B. Ketterson and P. R. Roach 1975 43 p refs Presented at the 54th Ann. Meeting of Transportation Res. Board, Washington D. C., 16 Jan. 1975 Sponsored by ERDA
(Contract W-31-109-eng-38)
(CONF-750120-1) Avail: NTIS HC $5.25

Measurements are presented of the pressure dependence of the attenuation and velocity of sound in the hydrodynamic regime and in both the normal and superfluid zero sound regime of He-3. The velocity and attenuation were studied at a frequency of 20.24 MHz and at pressures of 17.00, 21.00, 21.50, 21.80, 22.00, 23.17, 26.00, and 28.00 bar in the zero sound regime. In the hydrodynamic region the temperature dependence of the attenuation was studied at 5.48 and 10.02 MHz and at pressures of 0.69, 1.38, and 2.76 bar. At a pressure of 29.3 bar and frequency of 20.24 MHz the transition from hydrodynamic to zero sound behavior was studied for both the velocity and attenuation. In addition, the anisotropy of the velocity and the attenuation as a function of the angle between the direction of an applied external magnetic field and the sound propagation direction was observed in the superfluid A phase at a pressure of 26.0 bar; no anisotropy was observed in the B phase at 21.0 bar. Author (NSA)

N76-21993# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Instrumentation Papers.
THE USE OF AN ACOUSTIC ECHO SOUNDER FOR OPTICAL TRACKING APPLICATIONS
Duane A. Haugen, J. Chandran Kaimal, and Jim T. Newman 21 Aug. 1975 60 p refs
(AF Proj. 2646)
(AD-A018062; AFCRL-TR-75-0454; AFCRL-IP-239) Avail: NTIS CSCL 20/14

A pilot study to obtain data on the seeing quality of the atmosphere was conducted in August 1974 as part of ARPA's Compensated Imaging Program at the ARPA Maui Observation Station (AMOS). The AMOS site is located atop Mt. Haleakala, about 10,000 ft above sea level, on the island of Maui, Hawaii, presumably in an environment where degradation of optical tracking due to turbulent fluctuations in the index of refraction is minimal. As the compensated Imaging Program evolved, it became increasingly clear that detailed knowledge of atmospheric turbulence properties at AMOS was essential to the success of the program. One aspect of the pilot study conducted was to evaluate the feasibility of using an acoustic echo sounder to obtain that information. The results of that evaluation are summarized in this report. In general, subject to certain limitations, it was found that the acoustic echo sounder shows valuable potential as a remote probe for quantitative determination of the temperature structure parameter to heights in excess of 300 m. Since the temperature structure parameter is directly related to the refractive index structure parameter, the sounder is immensely useful for general application to optical propagation programs. GRA

N76-21994# National Inst. for Occupational Safety and Health, Morgantown, W.Va. Testing and Certification Lab.
INDUSTRIAL SOUND LEVEL METER VIBRATION SENSITIVITY TEST
Alwin Dieffenbach and Nick Blaskovich, Jr. Oct. 1975 26 p refs
(PB-247332/0; NIOSH/TC/P-001) Avail: NTIS HC $4.00 CSCL 06J

A test procedure devised to evaluate an industrial sound level meter for characteristics of amplifier distortion is presented. A list of the equipment necessary to perform the test, the configuration in which the equipment is to be used, and a sequenced step by step procedure for performing the evaluation is included. An automated version of the procedure using a programmable calculator system is also presented. GRA

N76-21995# National Inst. for Occupational Safety and Health, Morgantown, W.Va. Testing and Certification Lab.
INDUSTRIAL SOUND LEVEL METER AMPLIFIER DISTORTION TEXT
Robert J. Koshut and Nick Blaskovich, Jr. Oct. 1975 24 p refs
(PB-247333/8; NIOSH/TC/P-002) Avail: NTIS HC $3.50 CSCL 06J

For abstract, see N76-21994.

N76-21996# Naval Underwater Systems Center, New London, Conn.
COMPUTER MODELS FOR UNDERWATER SOUND PROPAGATION
Frederick R. DiNapoli 31 Oct. 1975 33 p refs
(NUSC Proj. A-650-02; SF52522701)
(AD-A017877; NUSC-TD-5267) Avail: NTIS CSCL 20/1

The state of affairs of computer models for underwater sound propagation loss estimation is discussed from the viewpoints of two segments of the sonar community, i.e., (1) those who develop the models and are primarily concerned with the accuracy of the estimations and (2) those who use such models and view propagation loss as only one of many areas in which sub-models are required. A list of propagation models, classified according to the analytical methods used in their derivations, is presented. The features and shortcomings of each class are then discussed in broad terms. Various sonar applications for which knowledge of propagation loss is needed are briefly delineated to indicate their diversity. Finally, various aspects of model assessment are addressed and a method for the quantitative assessment of comparative model accuracy (now in formative stages of development) is presented. GRA

N76-21997# Pennsylvania State Univ., University Park. Applied Research Lab.
SPATIAL AND SPECTRAL FILTERING AS APPLIED TO

ARRAY PROCESSING Ph.D. Thesis
Frank W. Symons, Jr. 18 Sep. 1975 288 p refs
(Contract N00017-73-C-1418)
(AD-A017785; TM-75-227) Avail: NTIS CSCL 20/1

Algorithms have been developed that can be flexibly applied to the processing of discrete directional interference, out-of-band look-direction interference, and in-band look-direction interference, all of which are frequently encountered in array processing. Discrete directional interference is handled by a recursive adaptive LMS processor which steers linear array pattern nulls to spatially filter the interference. The form of the processor is controlled by choosing the elements of a selection matrix in its interference estimation channel. The selection matrix chooses subsets of the input array for use in forming an estimate of the interference which is subtracted from the output of a uniform array which is used to focus on the look-direction waveforms. Look-direction waveforms remain undistorted whether using a constrained or unconstrained form of the spatial processing algorithm. Out-of-band look-direction interference is processed by choosing the appropriate filter order out of a set of preprogrammed complex digital Butterworth filters. In-band look-direction interference is handled by an LMS processor that uses time correlations on an FIR to steer a spectral notch to perform the required filtering. The processor may be implemented by either a direct algorithm that correlates the time samples and uses a recursive algorithm to solve the correlation equations involved or by a recursive adaptive algorithm. The properties of each of the processors are developed and performance capabilities illustrated. GRA

N76-21998# Georgetown Univ., Washington, D.C. Dept. of Physics.
A UNIFORMED THEORETICAL DESCRIPTION OF ULTRASONIC BEAM REFLECTIONS FROM A SOLID PLATE IN A LIQUID Technical Report, 1 Oct. - 1 Dec. 1975
Leslie E. Pitts 1 Dec. 1975 109 p refs
(Contract N00014-75-C-0333; NR Proj. 307-352)
(AD-A018162; GUUS-11755; TR-5) Avail: NTIS CSCL 20/1

The study represents a theoretical analysis of reflectivities from a solid bounded by a liquid; specifically, it takes into account the dimensions of the solid as compared to the wavelength of the incident sonic signal. The result of the study is a unified theory which explains certain equivalencies between the Rayleigh mode of vibration (when the solid is infinitely thick) and the various Lamb modes (when the reflecting solid has finite dimensions, i.e., when the reflecting solid has a plate-like structure). A knowledge of the reflection coefficient for an ice water interface is of importance when a sonic event takes place in the water and sound energy reaches the ice. GRA

N76-21999# Naval Surface Weapons Center, White Oak, Md.
MICROPHONE ARRAY LOCATION FROM SOUNDING MADE BY A PASSING PROJECTILE
Walter P. Reid 17 Apr. 1975 15 p ref
(MAT Proj. 03L-000; ZR0000101)
(AD-A011048; NSWC/WOL/TR-75-46) Avail: NTIS CSCL 17/1

The location of an array of microphones and azimuth of its horizontal axes are determined by using differences in arrival times of sound from a passing projectile as received at three pairs of microphones. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N76-22000*# Nebraska Univ., Lincoln. Behlen Lab. of Physics.
PHOTOIONIZATION OF ATOMS AND MOLECULES
James A. R. Samson 5 Apr. 1973 123 p refs
(Grant NGR-28-004-021)
(NASA-CR-146775) Avail: NTIS HC $5.50 CSCL 20H

A literature review on the present state of knowledge in photoionization is presented. Various experimental techniques that have been developed to study photoionization, such as fluorescence and photoelectron spectroscopy, mass spectroscopy, are examined. Various atoms and molecules were chosen to illustrate these techniques, specifically helium and xenon atoms and hydrogen molecules. Specialized photoionization such as in positive and negative ions, excited states, and free radicals is also treated. Absorption cross sections and ionization potentials are also discussed. Author

N76-22001*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
ROTATIONAL EXCITATION OF SYMMETRIC TOP MOLECULES BY COLLISIONS WITH ATOMS: CLOSE COUPLING, COUPLED STATES, AND EFFECTIVE POTENTIAL CALCULATIONS FOR NH3-He
Sheldon Green [1976] 41 p refs Prepared in cooperation with Columbia Univ., New York
(Grant NsG-7105)
(NASA-TM-X-72994) Avail: NTIS HC $4.00 CSCL 20H

The formalism for describing rotational excitation in collisions between symmetric top rigid rotors and spherical atoms is presented both within the accurate quantum close coupling framework and also the coupled states approximation of McGuire and Kouri and the effective potential approximation of Rabitz. Calculations are reported for thermal energy NH3-He collisions, treating NH3 as a rigid rotor and employing a uniform electron gas (Gordon-Kim) approximation for the intermolecular potential. Coupled states are found to be in nearly quantitative agreement with close coupling results while the effective potential method is found to be at least qualitatively correct. Modifications necessary to treat the inversion motion in NH3 are discussed. Author

N76-22002*# California Univ., Berkeley. Dept. of Physics.
NEAR THRESHOLD RESPONSE OF A WAVE SHIFTED CERENKOV RADIATOR TO HEAVY IONS
Steven P. Ahlen, Brian G. Cartwright, and Gregory Tarle [1976] 16 p refs
(Grant NGR-05-003-376)
(NASA-CR-146797) Avail: NTIS HC $3.50 CSCL 20H

The response of Pilot 425 to heavy ions with energies less than 600 MeV/amu beta approximately 0.8 is examined both theoretically and experimentally. Measurements are presented from an experiment which employed a Ne-20 beam at many energies below 575 MeV/amu. The signal is assumed to come from three sources: (1) Cerenkov light from the heavy ion, (2) Cerenkov light from secondary electrons, and (3) scintillation of the radiator. It is found that the effective index of refraction is 1.518 and that scintillation is present at a level of approximately 2.7 percent of the Cerenkov signal for beta = 1 for Ne-20. The first of these values differs from values previously quoted in the literature. Author

N76-22003*# California Univ., Berkeley.
HEAVY ION FRAGMENTATION EXPERIMENTS AT THE BEVATRON Semiannual Report, 1 Oct. 1975 - 31 Mar. 1976
Harry H. Heckman 16 Apr. 1976 12 p refs Sponsored in part by ERDA
(Grant NGR-05-003-513)
(NASA-CR-146798; SSL-Ser-17-Issue-28) Avail: NTIS HC $3.50 CSCL 20H

Collaborative research efforts to study the fragmentation processes of heavy nuclei in matter using heavy ion beams of the Bevatron/Bevalac are described. The goal of the program is to obtain the single particle inclusive spectra of secondary nuclei produced at 0 deg by the fragmentation of heavy ion beam projectiles. The process being examined is B+T yields F + anything, where B is the beam nucleus, T is the target nucleus, and F is the detected fragment. The fragments F are isotopically identified by experimental procedures involving magnetic analysis, energy loss and time-of-flight measurements. Effects were also made to: (a) study processes of heavy nuclei in matter, (b) measure the total and partial production cross section for all isotopes, (c) test the applicability of high energy multiparticle interaction theory to nuclear fragmentation, (d) apply the cross section data and fragmentation probabilities to cosmic ray transport theory, and (e) search for systematic behavior of fragment production as a means to improve existing semi-empirical theories of cross-sections. Author

N76-22004*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MOLECULAR PHYSICS OF EQUILIBRIUM GASES: A HANDBOOK FOR ENGINEERS
C. Frederick Hansen Washington 1976 329 p refs (NASA-SP-3096) Avail: NTIS HC $9.50 CSCL 20J

The equilibrium thermodynamic properties of gases are evaluated for application to engineering problems. For individual titles, see N76-22005 through N76-22014.

N76-22005* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THERMODYNAMICS AND STATISTICAL MECHANICS
In its Mol. Phys. of Equilibrium Gases: A Handbook for Engrs. 1976 p 1-41 refs (For availability see N76-22004 12-72) CSCL 20J

The basic thermodynamic properties of gases are reviewed and the relations between them are derived from the first and second laws. The elements of statistical mechanics are then formulated and the partition function is derived. The classical form of the partition function is used to obtain the Maxwell-Boltzmann distribution of kinetic energies in the gas phase and the equipartition of energy theorem is given in its most general form. The thermodynamic properties are all derived as functions of the partition function. Quantum statistics are reviewed briefly and the differences between the Boltzmann distribution function for classical particles and the Fermi-Dirac and Bose-Einstein distributions for quantum particles are discussed. Author

N76-22006* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CHEMICAL EQUILIBRIUM
In its Mol. Phys. of Equilibrium Gases: A Handbook for Engrs. 1976 p 43-55 (For availability see N76-22004 12-72) CSCL 20J

The entropy of a gas system with the number of particles subject to external control is maximized to derive relations between the thermodynamic variables that obtain at equilibrium. These relations are described in terms of the chemical potential, defined as equivalent partial derivatives of entropy, energy, enthalpy, free energy, or free enthalpy. At equilibrium, the change in total chemical potential must vanish. This fact is used to derive the equilibrium constants for chemical reactions in terms of the partition functions of the species involved in the reaction. Thus the equilibrium constants can be determined accurately, just as other thermodynamic properties, from a knowledge of the energy levels and degeneracies for the gas species involved. These equilibrium constants permit one to calculate the equilibrium concentrations or partial pressures of chemically reacting species that occur in gas mixtures at any given condition of pressure and temperature or volume and temperature. Author

N76-22007* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
QUANTUM PRINCIPLES AND FREE PARTICLES
In its Mol. Phys. of Equilibrium Gases: A Handbook for Engrs. 1976 p 57-87 refs (For availability see N76-22004 12-72) CSCL 20J

The quantum principles that establish the energy levels and degeneracies needed to evaluate the partition functions are explored. The uncertainty principle is associated with the dual wave-particle nature of the model used to describe quantized gas particles. The Schroedinger wave equation is presented as a generalization of Maxwell's wave equation; the former applies to all particles while the Maxwell equation applies to the special case of photon particles. The size of the quantum cell in phase space and the representation of momentum as a space derivative operator follow from the uncertainty principle. A consequence of this is that steady-state problems that are space-time dependent for the classical model become only space dependent for the quantum model and are often easier to solve. The partition function is derived for quantized free particles and, at normal conditions, the result is the same as that given by the classical phase integral. The quantum corrections that occur at very low temperatures or high densities are derived. These corrections for the Einstein-Bose gas qualitatively describe the condensation effects that occur in liquid helium, but are unimportant for most practical purposes otherwise. However, the corrections for the Fermi-Dirac gas are important because they quantitatively describe the behavior of high-density conduction electron gases in metals and explain the zero point energy and low specific heat exhibited in this case. Author

N76-22008* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
RIGID ROTATORS
In its Mol. Phys. of Equilibrium Gases: A Handbook for Engrs. 1976 p 89-124 refs (For availability see N76-22004 12-72) CSCL 20J

The two-particle, steady-state Schroedinger equation is transformed to center of mass and internuclear distance vector coordinates, leading to the free particle wave equation for the kinetic energy motion of the molecule and a decoupled wave equation for a single particle of reduced mass moving in a spherical potential field. The latter describes the vibrational and rotational energy modes of the diatomic molecule. For fixed internuclear distance, this becomes the equation of rigid rotator motion. The classical partition function for the rotator is derived and compared with the quantum expression. Molecular symmetry effects are developed from the generalized Pauli principle that the steady-state wave function of any system of fundamental particles must be antisymmetric. Nuclear spin and spin quantum functions are introduced and ortho- and para-states of rotators, along with their degeneracies, are defined. Effects of nuclear spin on entropy are deduced. Next, rigid polyatomic rotators are considered and the partition function for this case is derived. The patterns of rotational energy levels for nonlinear molecules are discussed for the spherical symmetric top, for the prolate symmetric top, for the oblate symmetric top, and for the asymmetric top. Finally, the equilibrium energy and specific heat of rigid rotators are derived. Author

N76-22009* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DIATOMIC MOLECULE VARIATIONS
In its Mol. Phys. of Equilibrium Gases: A Handbook for Engrs. 1976 p 125-150 refs (For availability see N76-22004 12-72) CSCL 20J

The rotational energy is separated from vibrational energy in the two-particle, steady-state wave equation and to first order the solutions are harmonic oscillator functions. The classical phase integral gives a partition function valid only at high temperature, but the quantum summation is easily performed to give analytic expressions for all the thermodynamic properties of the harmonic oscillator at all temperatures. Anharmonic effects are treated by small perturbation solutions to the wave equation and the relation between energy levels and a series expansion of the perturbation potential is derived. Next, the quantum solutions for an oscillator with a Morse-function potential are derived in terms of Laguerre polynomials. Author

N76-22010* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
POLYATOMIC MOLECULE VIBRATIONS
In its Mol. Phys. of Equilibrium Gases: A Handbook for Engrs. 1976 p 151-195 refs (For availability see N76-22004 12-72) CSCL 20J

Polyatomic molecule vibrations are analyzed as harmonic vibrations along normal coordinates. The energy eigenvalues are found for linear and nonlinear symmetric triatomic molecules for valence bond models of the potential function with arbitrary coupling coefficients; such models can usually be fitted to observed energy levels with reasonably good accuracy. Approximate normal coordinates for the H2O molecule are discussed. Degenerate vibrational modes such as occur in CO2 are analyzed and expressions for Fermi resonance between close-lying states of the same symmetry are developed. The bending modes of linear triatomic molecules are expressed in terms of Laguerre polynomials in cylindrical coordinates as well as in terms of Hermite polynomials in Cartesian coordinates. The effects of large-amplitude bending such as occur in the C3 molecule are analyzed, along with anharmonic effects, which split the usually degenerate bending mode energy levels. Finally, the vibrational frequencies, degeneracies, and symmetry properties of XY3, X2Y2, and XY4 type molecules are discussed. Author

N76-22011* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ELECTRONIC ENERGY STATES

In its Mol. Phys. of Equilibrium Gases: A Handbook for Engrs. 1976 p 197-234 refs (For availability see N76-22004 12-72) CSCL 20J

One-electron wave functions are reviewed and approximate solutions of two-electron systems are given in terms of these one-electron functions. The symmetry effects associated with electron spin are reviewed and the effects of electron exchange on energy levels of the two-electron system are given. The coupling of electronic orbital and spin angular momentum is considered next and the Lande interval rule for Russell-Saunders or LS coupling is derived. The configurations possible for various multi-electron LS couplings are enumerated (examples from the first two rows of the periodic table are given), and the meaning of the spectroscopic nomenclature is discussed, particularly with respect to the degeneracies of the electron states involved. Next the nomenclature, symmetries, and degeneracies for electron states of diatomic molecules are discussed, and some examples for N2, O2, and NO are presented. The electronic partition functions and derivative thermodynamic properties are expressed in terms of these energies and degeneracies, and examples are given for some of the simple gas species encountered in the earth's atmosphere. Author

N76-22012* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

PARTITION FUNCTION CORRECTIONS

In its Mol. Phys. of Equilibrium Gases: A Handbook for Engrs. 1976 p 235-266 refs (For availability see N76-22004 12-72) CSCL 20J

The vibration-rotation interaction coupling in diatomic molecules is analyzed and first-order expressions for the energy levels are deduced. Corrections to the partition function to account for this coupling are derived. The effects of long-range intermolecular forces due to induced dipole-induced dipole interactions, dipole-induced dipole interactions, charge-dipole interactions, and charge-charge interactions are considered. London's quantized oscillator model of the induced dipole-induced dipole interaction is developed. The partition function including effects of such dispersion forces is derived and is shown to lead to the virial equation of state. For a model combining the hard sphere and long-range attractive type potentials, this is found to lead to the van der Waals equation of state. The equation of state near the critical point is presented in reduced form (thermodynamic variables expressed in units of critical point values). Finally, approximate corrections to the electronic partition functions are derived to account for perturbations of excited electronic states induced by neighboring neutral particles, heavy ions, and fast electron collisions. Author

N76-22013* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EQUILIBRIUM PROPERTIES OF CHEMICALLY REACTING GASES

In its Mol. Phys. of Equilibrium Gases: A Handbook for Engrs. 1976 p 267-286 refs (For availability see N76-22004 12-72) CSCL 20J

The equilibrium energy, enthalpy, entropy, specific heat at constant volume and constant pressure, and the equation of state of the gas are all derived for chemically reacting gas mixtures in terms of the compressibility, the mol fractions, the thermodynamic properties of the pure gas components, and the change in zero point energy due to reaction. Results are illustrated for a simple diatomic dissociation reaction and nitrogen is used as an example. Next, a gas mixture resulting from combined diatomic dissociation and atomic ionization reactions is treated and, again, nitrogen is used as an example. A short discussion is given of the additional complexities involved when precise solutions for high-temperature air are desired, including effects caused by NO produced in shuffle reactions and by other trace species formed from CO2, H2O and Ar found in normal air. Author

N76-22014* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

SOME APPLICATIONS OF EQUILIBRIUM THERMODYNAMIC PROPERTIES TO CONTINUUM GASDYNAMICS

In its Mol. Phys. of Equilibrium gases: A Handbook for Engrs. 1976 p 287-325 refs (For availability see N76-22004 12-72) CSCL 20J

The speed of sound for the propagation of isentropic disturbances in a gas is developed, including corrections for chemical reaction. The term zero frequency is used to describe this isentropic limit sound speed; the term signifies that change in the gasdynamic variables are all very slow compared with the chemical rate changes in the gas. A faster, nonisentropic speed of propagation occurs for disturbances where the changes in gasdynamic variables are fast compared with the chemical rate changes. In the limit, this is known as the infinite frequency or frozen sound speed - the former term calling attention to the very high frequency of the disturbance, the latter term calling attention to the frozen character of the chemical reactions under such rapid changes of state. The true sound speed for a disturbance of finite frequency is shown to be between these two limits and is expressed in terms of the chemical relaxation time. The Riemann invariants that are useful in determining the changes in flow speed along characteristic directions in supersonic flow are derived in terms of integrations of acoustic impedance, and example results are given for air. Author

N76-22015# Sandia Labs., Albuquerque, N.Mex.

REPLACEMENT COLLISION PROBABILITIES FOR ENERGETIC INCIDENT IONS

D. K. Brice 1975 22 p refs Presented at Intern. Conf. on Appl. of Ion Beams to Mater., Warwick, Engl. Sponsored by ERDA

(SAND-75-5526; Conf-750926-1) Avail: NTIS HC $4.25

Calculations are presented of P(E), the exact integral equation which governs the replacement probability as a function of incident ion energy in an elastic interaction with a target atom. The calculations are numerical solutions as a function of ion energy and mass, and are obtained using the Thomas-Fermi elastic scattering cross section. NSA

N76-22016# Oak Ridge National Lab., Tenn.

BACKSCATTERING OF LIGHT IONS FROM METAL SURFACES

H. Verbeek Jul. 1975 31 p refs Presented at Symp. on Radiation Effects on Solid Surfaces, Chicago, 25 Aug. 1975 Sponsored by ERDA

(Conf-750839-1) Avail: NTIS HC $4.75

When a metal target is bombarded with light ions some are implanted and some are reflected from the surface or back-scattered from deeper layers. This results in an energy distribution of the backscattered particles which reaches from zero to almost the primary energy. The number of the backscattered particles and their energy, angular, and charge distributions depends largely on the energy and the ion target combination. For high energies (i.e., greater than 50 keV for protons) particles are backscattered in a single collision governed by the Rutherford cross section. Protons and He-ions with energies of 100 keV to several MeV are widely used for thin film analysis. For lower energies multiple collisions and the screening of the Coulomb potential have to be taken into account, which makes the theoretical treatment more difficult. This energy region is, however, of special interest in the field of nuclear fusion research. Some recent results for energies below 20 keV are discussed in some detail. Author (NSA)

N76-22017# Los Alamos Scientific Lab., N.Mex.

PARTICLE-TRANSPORT SIMULATION WITH THE MONTE CARLO METHOD

L. L. Carter and E. Cashwell 1975 123 p refs Sponsored by ERDA

(TID-26607) Avail: NTIS HC $5.45

Attention is focused on the application of the Monte Carlo method to particle transport problems, with emphasis on neutron and photon transport. Topics covered include sampling methods, mathematical prescriptions for simulating particle transport, mechanics of simulating particle transport, neutron transport, and photon transport. A literature survey of 204 references is included. NSA

N76-22018# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.

ENGINEERING OF CALCULATION OF HIGH ENERGY PROTON AND ELECTRON SYNCHROTRON SHIELDING
L. N. Zaitsev 1975 20 p refs
(JINR-P16-8871) Avail: ERDA Depository Libraries HC $4.00

Extremely simple and universal way was suggested for calculation of the shielding of any configuration (except the traps) over the given losses of accelerated particles in the energy range from 1 up to 2,000 GeV. The way is confortable when operatively solving the problems of shielding and predicting the radiation situation. The error of the shielding thickness calculations is less than 10%. Author (NSA)

N76-22019# Ames Lab., Iowa.
CALCULATED PRESSURE-BROADENED LINEWIDTHS OF OZONE
G. D. T. Tejwani and E. S. Yeung Apr. 1975 79 p refs
(Contract W-7405-eng-82)
(IS-3575) Avail: NTIS HC $7.00

Self-broadened and foreign-gas (N2 and O2) broadened linewidths of O3 at 300 K for a wide range of quantum numbers J and K/sub a/, for both type A and type B bands, were calculated using the Anderson-Tsao-Curnutte theory of line broadening. In the case of O3-O3 collisions, dipole-dipole, dipole-quadrupole, quadrupole-dipole, and quadrupole-quadrupole interactions were included. For O3-N2, and O3-O2 collision, dipole-quadrupole and quadrupole-quadrupole interactions were taken into account. Good agreement between the available measured linewidths with the computed values for corresponding transitions was obtained on using the molecular quadrupole moments of O3. These values were utilized for the components of quadrupole moment tensor for O3 in the extensive calculations of linewidths reported. Air-broadened linewidths of O3 at 200 K were also computed. Author (NSA)

N76-22020# Colorado Univ., Boulder. Dept. of Electrical Engineering.
THE PEIERLS INSTABILITY INCLUDING NON-LINEAR SCREENING
Robert Yeats and Herbert Kroemer Nov. 1975 52 p refs
(Contracts N00014-67-A-0405-0006; N00014-76-C-0115)
(AD-A018075) Avail: NTIS CSCL 20/8

The conditions are determined under which a Peierls instability (PI) will occur at T = 0 K for a nearly free electron model that includes electron-electron interaction. Nonlinearities are included in the screening. It is found that a PI requires gamma more than 1, where gamma is a parameter characterizing the electron-phonon interaction. Furthermore, it is found that when 1 <gamma, gamma = 1 the instability is likely to occur at q < 2k F rather than at q = 2k F, thus putting a gap below the Fermi level. This could have important observable consequences, which are discussed. The size of the instability gap is probably limited by anharmonicities rather than being limited by minimization of the total energy calculated in the harmonic approximation. It is significant that the most important contributions to the total energy for the screened PI are not present for the unscreened PI. Thus the gap is not expected to have a BCS type of temperature dependence, contrary to the case of the unscreened PI. Author

N76-22021# Naval Research Lab., Washington, D.C.
POLOIDAL STRUCTURE OF THE DISSIPATIVE TRAPPED ELECTRON DRIFT INSTABILITY Interim Report
Paulett Liewer, Wallace M. Manheimer, and William Tang Nov. 1975 22 p refs
(NRL Proj. H02-37)
(AD-A017770; NRL-MR-3154) Avail: NTIS CSCL 20/8

A study of the poloidal mode structure of the dissipative trapped electron drift mode by Fourier analysis shows that when ion inertia effects are small compared to trapped electron effects, the mode balloons out in the region of trapped particles. When ion inertia effects are large, there is no ballooning and the growth rates are lower. Author (GRA)

N76-22022# Science Applications, Inc., La Jolla, Calif.
THEORETICAL STUDIES OF RADIOACTIVE DEBRIS ATTACHMENT TO ABM MATERIALS Final Report, 1 May 1974 - 30 Apr. 1975
W. Malkmus and G. M. Reynolds Sep. 1975 42 p refs
(Contract DAAD05-74-C-0768; DA Proj. 1W1-62113-A-659)
(AD-A017670; SAI-75-590-LJ; BRL-CR-260) Avail: NTIS CSCL 18/8

A computer program which has been developed to simulate the effect of an atom impinging on a solid surface is described. The computer code can accommodate an arbitrary number of different species in the lattice structure as well as an arbitrary number of adsorbed species on the surface of the lattice. Evaluation and selection of optimum potential representations for the atomic interactions are discussed. Results are presented for the predicted trajectories of neutral atoms incident on metallic lattices, for a range of incident particle energies and masses, and for various impact points and angles of impact. Author (GRA)

N76-22023# Missouri Univ., Kansas City. Dept. of Physics.
RESEARCH AND DEVELOPMENT OF TECHNIQUES FOR MEASURING THE INFRARED ABSORPTANCE OF THE FUNDAMENTAL VIBRATION-ROTATION BAND OF NO(+) Final Report, 25 Feb. 1972 - 30 Jun. 1974
Marvin R. Querry, John Urani, Robert Phillips, and Gary Hoover L. G. Hanscom Field, Mass. AFCRL 11 Mar. 1975 93 p refs
(Contract F19628-72-C-0247; AF Proj. 8658)
(AD-A017739; AFCRL-TR-75-0219) Avail: NTIS CSCL 07/4

The ultimate goal of this program of research was to measure the strength of the fundamental vibrational-rotational band of NO(+) which is centered at about 4.3 micrometer (2325/cm) in the infrared. A theoretical analysis was made of the fractional absorptance of monochromatic radiation by the fundamental vibrational-rotational band of NO(+). Equipment constructed or partially constructed for this project included a high-vacuum pumping station, pressure gauges, a gas-handling manifold, as gas purification system a radio-frequency generator, an infrared source and chopper assembly, a lead-selenide detector assembly, two photomultiplier-tube units, a long path length white cell, and parts of a data acquisition system. A PbS(x)Se(1-x) diode-laser system would be required to observe the absorption in NO(+) at low pressures. GRA

N76-22024# Ohio State Univ., Columbus. Dept. of Physics.
DOMAIN STRUCTURE OF A REGGEON FIELD THEORY WITH THREE COUPLINGS
K. A. Geer and S. S. Pinsky 1974 17 p refs
(Contract AT(11-1)-1545)
(COO-1545-153) Avail: NTIS HC $4.00

The high energy behavior of a Reggeon field theory with a three-Reggeon coupling and two four-Reggeon couplings is considered. Using the renormalization group equations which are calculated in lowest order for this model, the way that the couplings evolve to the fixed points in the high energy limit is studied. It was found that there are three fixed points (plus a fourth at infinity) to which the couplings can evolve. The space of couplings divides into four domains, two of which are two-dimensional and two of which are three-dimensional. The couplings in one of the three-dimensional domains are found to evolve to infinity and the couplings in the other three domains are found to evolve to the fixed point couplings. The boundaries of these domains and some characteristic evolution curves are shown. The implications of the domain structure of the model are discussed. Author (NSA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N76-22025*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
ELECTRON PARAMAGNETIC RESONANCE INVESTIGATION OF A FAMILY OF CARBON BLACKS BETWEEN 4.2 AND 300 K
P. Delhaes and F. Carmona Washington NASA Apr. 1976 29 p refs Transl. into ENGLISH from Carbon (Engl.), v. 10, 1972 p 677-690 Original in FRENCH
(Contract NASw-2789)

(NASA-TT-F-16961) Avail: NTIS HC $4.00 CSCL 20H

An EPR study of the paramagnetism of the g-factor and the line width was carried out between 4.2 and 300 K for a carbon black. A phenomenological model based on a strong interaction between two spins systems, the localized centers and the conduction electrons, permits the derivation of additivity laws for these experimental results, values of parameters are found whose physical meaning is discussed. Author

N76-22026*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
ANISOTROPIES OF THE G FACTOR AND THE LINE WIDTH OF PYROGRAPHITES BETWEEN 300 AND 4.2 K; EFFECT OF NEUTRON IRRADIATION
Francois Carmona, Jacques Ameill, and Pierre Delhaes Washington NASA Apr. 1976 8 p refs Transl. into ENGLISH from C. R. H. Acad. Sci., Ser. B (Paris), v. 276, 2 May 1973 p 765-768
(Contract NASw-2789)
(NASA-TT-F-16960) Avail: NTIS HC $3.50 CSCL 20H

Results of electron paramagnetic resonance measurements for both irradiated and non-irradiated samples of pyrographites are presented. A qualitative interpretation of the thermal variations, which takes into account the number of defects present in these samples, is suggested. Author

N76-22027*# Scientific Translation Service, Santa Barbara, Calif.
RADIATION PROTECTION OF HIGH ENERGY ACCELERATORS
Eberhard Freytag Washington NASA Apr. 1976 172 p refs Transl. into ENGLISH of the book "Strahlenschutz an Hochenergiebeschleunigern" Karlsruhe, G. Braun, 1972 126 p
(Contract NASw-2791)
(NASA-TT-F-16910) Avail: NTIS HC $6.75 CSCL 20G

Interactions of elementary particles with matter up to high energies, as well as hadron and electron-photon cascades, are examined. Energy dose and equivalent dose, measurement instruments, shielding and radiation damage in material are also discussed. Author

N76-22028*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROTON AND DEUTERON DOUBLE DIFFERENTIAL CROSS SECTIONS AT ANGLES FROM 10 DEG TO 60 DEG FROM Be, C, Al, Fe, Cu, Ge, W, AND Pb UNDER 558-MeV-PROTON IRRADIATION
Sherwin M. Beck and Clemans A. Powell Washington Apr. 1976 143 p refs
(NASA-TN-D-8119; L-10597) Avail: NTIS HC $6.00 CSCL 20H

The double differential cross sections for the production of protons and deuterons from targets of Be, C, Al, Fe, Cu, Ge, W, and Pb were obtained at laboratory angles of scatter of 10, 20, 30, 40, 50, and 60 degrees for 558-MeV incident protons. The position of the quasi-elastic peak, discernible in the cross sections up to approximately 40 degrees, corresponded closely to the theoretical predictions for proton-proton elastic scattering at 558 MeV. The mean ratio of deuteron to proton energy-integrated cross sections was 0.056 + or - 0.008. The dependence of energy-integrated cross sections for both protons and deuterons on target mass number A varied from A to the 1/3 power at 10 degrees to A to the 2/3 power above approximately 30 degrees. The ratio of energy-integrated deuteron cross sections for quasielastic processes to that for reactions yielding a deuteron-pi-meson pair was approximately 10 percent. Author

N76-22029# Sandia Labs., Albuquerque, N.Mex.
ELECTRON BEAM FUSION TARGETS
M. A. Sweeney 12 Sep. 1975 17 p refs Presented at Conf. of the Dept. of Phys. and Astronomy, Albuquerque, N. Mex., 12 Sep. 1975 Sponsored by ERDA
(SAND-75-5691; Conf-750943-1) Avail: NTIS HC $4.00

Focused relativistic electron beams are receiving considerable attention as a means of imploding spherical targets a few millimeters in diameter to produce substantial thermonuclear yields. A central consideration of such proposals is the design of the targets and, in particular, design calculations which concentrate on reducing breakeven power levels. The behavior of e-beam fusion targets in which a low-Z (iron or carbon) ablator surrounds a high-Z, high-density (gold) pusher is compared to that of single gold shell targets. Both types of targets are irradiated by constant-power 1-MeV electron beam pulses. The use of a low-Z ablator decreases the bremsstrahlung heating of the pusher. The resulting colder and denser pusher is more effective.
Author (NSA)

N76-22030# European Organization for Nuclear Research, Geneva (Switzerland).
POWER LAWS IN PARTICLE PHYSICS
D. Amati and S. Fubini 11 Mar. 1975 37 p
(CERN-75-2) Avail: ERDA Depository Libraries HC $5.00

A theoretical survey of the different scaling asymptotic behaviors found in experimental data, and their connection with the underlying hadron dynamics is presented. As an initial classification of the phenomena, purely hadronic processes, and processes including weak or electromagnetic interactions, are considered, both in inclusive and exclusive reactions. The transition between different power laws is investigated. The main properties of the different scaling behaviors are treated, in the light of the parton and the multiperipheral models. The presence of logarithmic asymptotic behaviors and the dynamical origin of scales are discussed. Author (NSA)

N76-22031# California Univ., Irvine. Dept. of Physics.
HIGH ENERGY PHYSICS STUDY Progress Report, 1 Oct. 1973 - 30 Sep. 1974
P. Condon and J. Schultz 1974 16 p refs
(Contract AT(04-3)-34)
(UCI-34-P-149X3) Avail: NTIS HC $4.00

Progress is reported on research performed on three major projects: analysis and preparation of reports on a study of proton-antiproton interactions between 0.7 and 1.1 GeV/c incident antiproton momentum; analysis of an exposure in the 30 inch BNL chamber with deuterium fill and antiprotons beam; and small angle K/sub L/p and K/sub L/d scattering using a hybrid spark chamber/bubble chamber apparatus at the Stanford Linear Accelerator. Author (NSA)

N76-22032# Physical Power Inst., Obninsk (USSR).
ESTIMATE OF THE CONTRIBUTIONS OF THE STRAIGHT PROCESS OF SPECTRA IN THE INELASTIC SCATTERING OF NEUTRONS
A. A. Lukyanov, O. A. Salnikov, and E. M. Saprykin 1974 22 p refs In RUSSIAN
(FEP-472) Avail: ERDA Depository Libraries HC $4.25

In spectra of inelastically scattered neutrons obtained experimentally for a number of nuclei at neutron bombarding energies of 9.1 and 14.36 MeV the most characteristic differences in the energy and angular dependencies from the evaporation model spectrum are interpreted as a contribution of direct inelastic scattering on separate target nucleons. A simple scheme is developed for qualitatively estimating this contribution to the twofold differential cross sections of inelastic scattering, measured with a wide experimental resolution. As a result of the analysis it was possible to obtain identical nuclear temperatures T over all angles, to estimate the contribution of the direct process to the total cross sections of inelastic scattering, and to give a qualitative explanation of the observed asymmetry of the angular distribution of inelastically scattered neutrons within the framework of the shell model. NSA

N76-22033# Sandia Labs., Albuquerque, N.Mex.
IRRADIATION OF A SPHERICAL TARGET BY A SINGLE RELATIVISTIC ELECTRON BEAM
J. Chang, M. M. Widner, G. W. Kuswa, and G. Yonas 1975 11 p refs Presented at the IEEE Intern. Conf. on Plasma Sci., Ann Arbor, Mich., 14 May 1975 Sponsored by ERDA
(SAND-75-5029; Conf-750531-5) Avail: NTIS HC $4.00

An experimental study of single relativistic electron beam (REB) irradiation of spherical targets was conducted to determine deposition symmetry. A 700 keV, 300 kA, 100 nsec beam was used with diagnostics consisting of X-ray pinhole photography, flash radiography, and evaluation of anode backing plate damage. The degree of symmetry was typically much better than 2 : 1 over the target surface, indicating that single beam irradiation could be an acceptable approach to pellet fusion. Author (NSA)

N76-22034# Nebraska Univ., Lincoln.
BEVALAC EXPERIMENTS SUGGESTED BY TRACK THEORY
Robert Katz 1973 39 p refs Presented at the Conf. on Heavy Ion Res. in Radiol. Phys. and Radiation Chem. with Bevalac ions, Berkeley, Calif., 1-2 Nov. 1973 Sponsored by ERDA and NSF
(COO-1671-54; Conf-731156-1) Avail: NTIS HC $5.00

Track structure theory is discussed for detectors having different interactive element size and different metastable lifetimes, which can affect the dose rate dependent response of the detector. A group of experiments is proposed to be done on the Bevalac accelerator to improve or test track structure theory, and to improve the quality of engineering and of detector theory through a reduction in the uncertainty of the fitted parameters. (GMT)
NSA

74 OPTICS

Includes light phenomena.

N76-22035# California Univ., Livermore. Lawrence Livermore Lab.
LENS AND MIRROR DESIGN VIA THE PRINCIPAL SURFACE
A. Greenbaum and J. B. Trenholme 14 Jul. 1975 19 p refs Presented at the Intern. Lens Design Conf., Haverford, Pa., 26 Jun. 1975 Sponsored by ERDA
(UCRL-76639; Conf-750679-1) Avail: NTIS HC $4.50

The problem of optical design is stated as follows: Given a principal surface r(alpha), and a maximum focal angle alpha/sub m/, find the pair of optical surfaces for which diffraction limited focusing is achieved. It is shown that specification of r(alpha) and alpha/sub m/ uniquely determines the lens design to within a scale factor, given the refractive index of the lens. It is further shown that one straightforward Runge-Kutta integration routine generates both surfaces for either a lens or a pair of mirror surfaces. The complete family of aplanatic lenses is described. Deviation from sphericity is discussed, as well as the possibility of realizing the specified lens designs. The family of lenses which map uniform incident intensity into uniform illumination about the focus is also described. Extension of the method of off-axis aberrations is considered. Author (NSA)

N76-22036# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
OPTICAL BEAM PROPAGATION IN TURBULENT MEDIA Physical Sciences Research Papers
Ronald L. Fante 13 Aug. 1975 75 p refs
(AF Proj. 2153)
(AD-A018061; AFCRL-TR-75-0439; AFCRL-PSRP-640) Avail: NTIS CSCL 20/14

The most recent developments on the propagation of microwave and optical beams in turbulent media, such as the clear atmosphere are discussed. Among the phenomena considered are beam spreading, beam wander, loss of coherence, scintillations, angle-of-arrival variations, and short pulse effects. Also included is a discussion of methods of compensation of the effect of turbulence on communications and imaging systems. GRA

N76-22037# Systems Research Labs., Inc., Dayton, Ohio.
A DIGITAL SYSTEM FOR THE CHARACTERIZATION OF ELECTRO-OPTICAL SENSORS Interim Report, Jul.-Dec. 1974
Lawrence Rohr and John Weinhold Sep. 1975 83 p
(Contract F33615-73-C-1135; AF Proj. 2004)
(AD-A017742; AFAL-TR-75-58) Avail: NTIS CSCL 17/8

A video signal measurement system which provides more reliable estimates of the performance parameters of E-O sensors than has been possible using previous methods is described. This system, consisting of 100 MHz sample-rate transient recorder interfaced to a minicomputer, acquires data from a sensor under test at near-real-time rates and then rapidly analyzes the data to obtain performance parameter estimates. The use of the system for the measurement of signal-to-noise ratios, signal transfer functions, spectral transfer functions, modulation transfer functions, aperture response, and noise spectral density are described. The measurement of the above parameters under static and dynamic conditions with stationary and moving targets is discussed. Results of measurements performed on a low light level television sensor are given along with a comparison of the measurements obtained on this sensor using standard analog methods. GRA

N76-21511* Massachusetts Inst. of Tech., Cambridge. Physics Dept.
OPTICAL ELECTRONICS
Ali Javan *In* NASA. Ames Res. Center 2d NASA Conf. on Laser Energy Conversion 1976 p 61-66 refs (For availability see N76-21505 12-36)
CSCL 20F

N76-21512* California Univ., Berkeley. Dept. of Electrical Engineering and Computer Sciences.
OPTICAL DIODES
T. Kenneth Gustafson *In* NASA. Ames Res. Center 2d NASA Conf. on Laser Energy Conversion 1976 p 67-79 refs (For availability see N76-21505 12-36)
CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N76-22038# Nagoya Univ. (Japan). Inst. of Plasma Physics.
A STABLE PRODUCTION OF INTENSE ELECTRON BEAM PLASMA WITH ION BACK STREAM
Johshin Uramoto Dec. 1975 19 p refs
(IPPJ-237) Avail: NTIS HC $3.50

An intense electron beam is extracted without space charge limit from a dc plasma source along a magnetic field. The beam space charge is neutralized stably through back streaming of self-ionized ions from the beam extracting anode region where a neutral gas is fed locally. In Appendix I, a space charge free electron gun is designed under this neutralization method. In Appendix II, a dynamic discharge through a series resistance is described, where an operative mechanism of the well-known TP-D plasma is clarified. Author

N76-22039# Nagoya Univ. (Japan). Inst. of Plasma Physics.
STUDY OF HELICAL PLASMA EQUILIBRIA
Y. Hamada, Y. Suzuki, K. Ohasa, M. Fujiwara, and K. Miyamoto Nov. 1975 21 p refs
(IPPJ-238) Avail: NTIS HC $3.50

The equilibrium of the plasma limited by the material limiter or the separatrix in the linear stellarator system was solved numerically by the finite difference method. The expansion and the deformation of the plasma column due to the longitudinal plasma current and the plasma pressure were obtained and were in agreement with the predicted values in the simple case where the analytical solutions were already found. Author

N76-22040# Nagoya Univ. (Japan). Inst. of Plasma Physics.
TRAVELING WAVE MULTIPLE MIRROR FIELD FOR CONFINEMENT OF HIGH TEMPERATURE PLASMAS
Shuko Aihara Nov. 1975 20 p refs
(IPPJ-234) Avail: NTIS HC $3.50

Traveling wave multiple mirror confinement of high temperature plasma for fusion application was examined by theoretical discussion using a diffusion equation. It was shown that confinement time and plasma density in the traveling wave multiple mirror field were several hundred times longer and higher than those in the static multiple mirror field. Author

N76-22041# Nagoya Univ. (Japan). Inst. of Plasma Physics.
WAVE PROPAGATION NEAR THE LOWER HYBRID RESONANCE IN TOROIDAL PLASMAS
K. Ohkubo, K. Ohasa, and K. Matsuura Oct. 1975 29 p refs
(IPPJ-233) Avail: NTIS HC $4.00

Dielectric tensor and equipotential curves (ray trajectories) of an electrostatic wave near the lower hybrid resonance are investigated for the toroidal plasma with a shear magnetic field. The ray trajectories start from the vicinity of the plasma surface, and rotate in a spiral form around the magnetic axis, and then reach the lower or upper parts of lower hybrid resonance layer. The numerical computations are performed on the parameters of JIPP T-II device with two dimensional inhomogeneity. Author

N76-22042# Nagoya Univ. (Japan). Inst. of Plasma Physics.
DAISEN SUMMER SCHOOL: LASER FUSION WORKSHOP
Nov. 1975 59 p refs Workshop held in Japan, 16-22 Jul. 1975
(IPPJ-235) Avail: NTIS HC $4.50

A new type of laser fusion reactor is described that consists of a small core pellet and a large outer pellet. A detailed study of megagauss magnetic field generation in resonant absorption of laser light takes into account effects of both dissipation and thermal motion of electrons. Also studied are the brief design of a steady state fusion burner for gigawatt output power, and fast ion generation in a laser target plasma. Author

N76-22043# Nagoya Univ. (Japan). Inst. of Plasma Physics.
IMPORTANCE OF FIELD-REVERSING ION RING FORMATION IN HOT ELECTRON PLASMA
Kazunari Ikuta Nov. 1975 13 p refs
(IPPJ-232) Avail: NTIS HC $3.50

Formation of the field reversing ion ring in the mirror confined hot electron plasma may offer a device to confine the fusion plasma even under the restriction of the present technology. Author

N76-22044# Nagoya Univ. (Japan). Inst. of Plasma Physics.
MODULATIONAL INSTABILITY AND ENVELOPE-SOLITONS FOR NONLINEAR ALFVEN WAVES PROPAGATING ALONG THE MAGNETIC FIELD IN COLD PLASMAS
K. Mio, T. Ogino, K. Minami, and S. Takeda Nov. 1975 24 p refs
(IPPJ-236) Avail: NTIS HC $3.50

The modulational instability and envelope-solitons for the Alfven waves propagating along the static magnetic field in cold collisionless plasmas are analyzed using the modified nonlinear Schroedinger equation derived previously by the authors. It is shown that the modulational instability exists for a small amplitude but does not for an amplitude larger than the critical value in the case of the left-hand circularly polarized Alfven wave (left Alfven wave). On the other hand, the modulational instability does not exist for the right-hand circularly polarized Alfven wave (right Alfven wave). Without the modulational instability, the rarefactive and compressive envelope-solitons exist for the left Alfven wave and the two types of the rarefactive envelope-solitons for the right Alfven wave. Author

N76-22045# Laboratori Gas Ionizzati, Rome (Italy).
THE PLASMA FOCUS EXPERIMENT. A SURVEY OF AVAILABLE RESULTS AND PRESENT KNOWLEDGES
Ch. Maisonnier, F. Pecorella, and J. P. Rager 21 Apr. 1976 42 p refs
(GI.R/PLAD/75.3/E) Avail: NTIS HC $4.00

Research on plasma physics, magnetohydrodynamics, and nuclear fusion in Italy is reported. A literature review of similar work in other countries (U.S.S.R., United States) is given. thermonuclear reactions (neutron production) in Mather and Filippov devices are discussed. Sketches of the devices are included, along with histograms of neutron spectra. Photographs of plasma dynamics in the Mather device (X ray cinematography) are shown. J.R.T.

N76-22046*# Vanderbilt Univ., Nashville, Tenn. Dept. of Physics and Astronomy.
INVESTIGATION OF HIGH ENERGY RADIATION FROM A PLASMA FOCUS Final Report, Feb. 1969 - Aug. 1975
Ja H. Lee, Charles E. Roos, and John P. Barach Aug. 1975 110 p refs
(Grant NGR-43-002-031)
(NASA-CR-146851) Avail: NTIS HC $5.50 CSCL 20I

Included are seventeen topics covering the experimental setup, diagnostics, analyses and various applications of the plasma focus. An invention, a hypocycloidal-pinch apparatus, is also included. Author

N76-22047*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHARACTERISTICS OF THE NASA LEWIS BUMPY TORUS PLASMA GENERATED WITH HIGH POSITIVE OR NEGATIVE APPLIED POTENTIALS
J. Reece Roth and Glenn A. Gerdin Washington Apr. 1976 63 p refs
(NASA-TN-D-8211; E-8574) Avail: NTIS HC $4.50 CSCL 20I

The toroidal ring of plasma contained in the NASA Lewis bumpy-torus superconducting magnet facility may be biased to positive or negative potentials approaching 50 kilovolts by applying direct-current voltages of the respective polarity to 12 or fewer of the midplane electrode rings. The electric fields which are responsible for heating the ions by E/B drift then point radially outward or inward. The low-frequency fluctuations below the ion cyclotron frequency appeared to be dominated by rotating spokes. Author

N76-22048# Indian Inst. of Tech., Bombay. Dept. of Mathematics.
UNSTEADY MPD FLOW IN A MHD GENERATOR Annual Progress Report, 16 Jun. - 31 Dec. 1975
M. L. Mittal 31 Dec. 1975 21 p refs Sponsored by CSIR
Avail: NTIS HC $3.50

Nonstationary flow in an MHD channel with time dependent pressure gradients was analyzed. The numerical calculations and graphs give the flow and amount of disturbance in the power output for various cases. Author

N76-22049# Energy Research and Development Administration, Washington, D.C. Div. of Controlled Thermonuclear Research.
FUSION POWER BY MAGNETIC CONFINEMENT
[1975] 24 p
(ERDA-11) Avail: NTIS MF $2.25; SOD HC $1.20

This report graphically explains the principal aspects of nuclear fusion. It illustrates how thermal energy is used to generate electricity, how energy can be produced from nuclear fusion, how the present research and development program is oriented, and finally how present efforts can lead to commercial nuclear fusion power. Author (NSA)

N76-22050# California Univ., Livermore. Lawrence Livermore Lab.
DESIGN OF A REPETITIVELY PULSED MEGAJOULE DENSE-PLASMA FOCUS
O. Zucker, W. Bostick, R. Gullickson, J. Long, J. Luce, and H. Sahlin 1 Aug. 1975 58 p refs
(Contract W-7405-eng-48)
(UCRL-51872) Avail: NTIS HC $5.45

A 1 pulse per second, dense-plasma-focus (DPF) materials-testing device capable of delivering a minimum of 10 to the 15th power neutrons per pulse is described. Moderate scaling up from existing designs is shown to be sufficient to provide 2 x 10 to the 13th power neutrons/sq cm s to a suitable target. The average power consumption, which has become a major issue due to the energy crisis, is analyzed with respect to other plasma devices and is shown to be highly favorable. Also discussed is an approach to capacitor-bank and switch design with respect to repetitive-pulse operation. Author (NSA)

N76-22051# California Univ., Livermore. Lawrence Livermore Lab.
FUSION POWER: THE TRANSITION FROM FUNDAMENTAL SCIENCE TO FUSION REACTOR ENGINEERING
R. F. Post 25 Jul. 1975 42 p refs Presented at IEEE Eascon Meeting, Washington, D. C., 29 Sep. 1975 Sponsored by ERDA
(UCRL-77055; Conf-750948-1) Avail: NTIS HC $5.25

The historical development of fusion research is outlined. The basics of fusion power along with fuel cost and advantages of fusion are discussed. Some quantitative requirements for fusion power are described. NSA

N76-22052# Los Alamos Scientific Lab., N.Mex.
NUMERICAL SIMULATION OF THE LOWER HYBRID DRIFT INSTABILITY
D. W. Hewett and D. Winske 1975 5 p refs Presented at the 3D Topical Conf. on Pulsed High Beta Plasmas, Abingdon, Engl., 9 Sep. 1975
(Contract W-7405-eng-36)
(LA-UR-75-1506; Conf-750944-3) Avail: NTIS HC $4.00

Particle simulations of strongly inhomogeneous plasma phenomena that model theta-pinch behavior in the implosion and post-implosion phases were performed using an inhomogeneous, self-consistent Vlasov equilibrium as an initial state. In the hot ion regime, a strong flute instability was observed, whose properties agree well with those predicted by the linear and nonlinear theory of the lower-hybrid-drift instability.
Author (NSA)

N76-22053# Los Alamos Scientific Lab., N.Mex.
SCYLLAC FEEDBACK STABILIZATION EXPERIMENTS
E. L. Cantrell, W. R. Ellis, B. L. Freeman, R. F. Gribble, W. D. Gutscher, K. J. Johnson, K. F. Kutac, G. Miller, and W. E. Quinn 1975 5 p refs Presented at the 3d Topical Conf. on Pulsed High Beta Plasmas, Abingdon, Engl., 9 Sep. 1975
(Contract W-7405-eng-36)
(LA-UR-75-1541; Conf-750944-7) Avail: NTIS HC $4.00

For feedback stabilization experiments the magnetic field in a 120 deg sector of the Scyllac torus was lowered to 17 kG, and the plasma parameters adjusted accordingly to reduce the m equals 1 instability growth rates to values which are compatible with the response time of the feedback system. Initial plasma studies were completed and compared with MHD sharp-boundary theory. Studies of the effectiveness of 1 equals 0 and 1 equals 2 feedback fields are reported. Modifications of the Scyllac feedback stabilization system have resulted in improved reliability, decreased response times, and increased output currents.
Author (NSA)

N76-22054# Los Alamos Scientific Lab., N.Mex.
TIME-DEPENDENT CALCULATIONS OF EQUILIBRIUM AND STABILITY PROBLEMS IN SCYLLAC AND TOKAMAK GEOMETRIES
J. U. Brackbill and D. C. Barnes 1975 5 p Presented at the 3d Topical Conf. on Pulsed High Beta Plasmas, Abingdon, Engl., 9 Sep. 1975
(Contract W-7405-eng-36)
(LA-UR-75-1577) Avail: NTIS HC $4.00

In preparation for a study of the equilibrium and stability properties of Scyllac, a sequence of problems was studied by numerically solving the MHD equations in three dimensions. Among these are computations of the dynamics of nonequilibrium plasmas in toroidal theta pinches and high beta Tokamaks, which illustrate what happens when there is no equilibrium as well as the approach to equilibrium when one exists. The evolution of Kruskal-Shafranov modes in a diffuse screw pinch was also computed from small amplitude to its final nonlinear state. The application of the same method to Scyllac is shown.
Author (NSA)

N76-22055# Los Alamos Scientific Lab., N.Mex.
NUMERICAL STUDIES OF THE LINEAR THETA PINCH
J. U. Brackbill 1975 5 p refs Presented at the 3d Topical Conf. on Pulsed High Beta Plasmas, Abingdon, Engl., 9 Sep. 1975
(Contract W-7405-eng-36)
(LA-UR-75-1568; Conf-750944-11) Avail: NTIS HC $4.00

Aspects of several physical problems associated with linear theta pinches were studied using recently developed numerical methods for the solution of the nonlinear equations for time-dependent magnetohydrodynamic flow in two- and three-dimensions. The problems studied include the propagation of end-loss produced rarefaction waves, the low produced in a proposed injection experiment geometry, and the linear growth and nonlinear saturation of instabilities in rotating plasmas, all in linear geometries. The studies illustrate how numerical computations aid in flow visualization, and how the small amplitude behavior and nonlinear fate of plasmas in unstable equilibria can be connected through the numerical solution of the dynamical equations. Author (NSA)

N76-22056# Los Alamos Scientific Lab., N.Mex.
SCYLLAC FUSION TEST REACTOR DESIGN
R. K. Linford, T. A. Oliphant, and K. I. Thomassen 1975 5 p Presented at the 3d Topical Conf. on Pulsed High Beta Plasmas, Abingdon, Engl., 9 Sep. 1975
(Contract W-7405-eng-36)
(LA-UR-75-1502) Avail: NTIS HC $4.00

The SFTR is a proposed 80-m diameter D-T burning toroidal theta pinch. The system is designed to achieve Q equals 1 where Q is the ratio of the total thermonuclear energy output to the maximum stored energy in the plasma. The SFTR design studies will provide valuable guidance to the Scyllac related research and to the needed technological development. The portion of the system directly related to the plasma confinement, stability, and heating is described, and the approach used to obtain an operating point consistent with Q equals 1, m equals 1 stability, and technological limitations is outlined. Author (NSA)

N76-22057# Los Alamos Scientific Lab., N.Mex.
LINEAR THETA PINCH AS A 14 MeV NEUTRON SOURCE
W. R. Ellis 1975 6 p Presented at the 3d Topical Conf. on Pulsed High Beta Plasmas, Abingdon, Engl., 9 Sep. 1975
(Contract W-7405-eng-36)
(LA-UR-75-1566; Conf-750944-2) Avail: NTIS HC $4.00

A linear theta pinch is considered as the neutron source in a fusion Engineering research facility (FERF). The device is optimized parametrically for maximum 14-MeV neutron flux through a test sample located between the discharge tube and the compression coil wall. A flux of approximately 10 to the 14th power h/sq cm/s can be achieved through a test-sample volume of 6.5 liters in a device 1.7 m long with a 150-kG magnetic field, 2:1 mirrors (300 kG) at the ends, a discharge frequency of 1.9 kHz, and a rotating-machinery power supply.
Author (NSA)

N76-22058# Oak Ridge National Lab., Tenn.
REDUCTION OF NEUTRAL PARTICLES REFLUXING INTO A PLASMA USE OF A HONEYCOMB
S. N. Cramer Oct. 1975 17 p refs Sponsored by ERDA
(ORNL-TM-4981) Avail: NTIS HC $4.00

The feasibility of honeycombing the first wall of a fusion reactor was investigated with regard to refluxing of neutral particles back into the plasma. The effect of the length-to-diameter ratio (L/D) of the honeycomb cell on the energy and angular distribution of refluxed particles was studied as well as the ratio of the refluxing from honeycomb and smooth walls. Honeycombing the wall with an L/D equals 1.5 cell was found to typically reduce the number of refluxed particles by a factor of 10 compared to a smooth wall. In addition, the total energy refluxing was reduced to approximately 6 percent of the comparable smooth wall value. The effect of the honeycomb on the emerging angular distribution of refluxed particles was minimal in the optimum honeycomb configuration (L/D from 1.0 to 2.0). Author (NSA)

N76-22059# Los Alamos Scientific Lab., N.Mex.
LASER FUSION, AN OVERVIEW
K. Boyer 1975 19 p refs Presented at 3d Conf. on the Laser, New York, 22 Apr. 1975
(Contract W-7405-eng-36)
(LA-UR-75-660; Conf-750460-1) Avail: NTIS HC $4.25

The laser fusion concept is described along with developments in neodymium and carbon dioxide lasers. Fuel design and fabrication are reviewed. Some spin-offs of the laser fusion program are discussed. NSA

N76-22060# California Univ., Los Angeles.
JOINT EXPERIMENTAL-THEORETICAL PROGRAM IN PLASMA PHYSICS OF CONTROLLED FUSION FOR THE PERIOD 1 JANUARY 1975 - 31 DECEMBER 1975
D. B. Fried, J. M. Dawson, A. Y. Weng, and F. F. Chen 1975 123 p refs
(Contract AT(11-1)-34)
(UCLA-34-P-157X8) Avail: NTIS HC $9.25

Summaries of research work during this report period are given for the following topics: (1) theoretical studies, (2) laser-plasma studies, (3) computer simulation of plasmas, and (4) experiments on plasma properties and plasma heating. NSA

N76-22061# Danish Atomic Energy Commission, Risoe.
ION ACOUSTIC WAVES IN THE PRESENCE OF HIGH FREQUENCY OSCILLATIONS
H. L. Pecseli Feb. 1975 20 p refs
(RISO-M-1790) Avail: ERDA Depository Libraries HC $4.00

Spatially varying high frequency oscillations will influence the electron motion in plasmas (through pondermotive forces) and in turn affect the characteristics of ion acoustic oscillations. The dielectric function is derived for long wavelength, low frequency ion acoustic waves in the presence of high frequency, short wavelength oscillations. Apart from reproducing well known results this dielectric function shows the possibility of unstable ion acoustic waves for extreme intensities of high frequency oscillations. It is demonstrated that moderate intensities have a stabilizing effect on linearly unstable double humped ion distribution functions and it is argued that this effect may be of importance in laboratory experiments. Author (NSA)

N76-22062# Illinois Univ., Urbana.
REACTIVITIES FOR TWO-COMPONENT FUSION CALCULATIONS
G. H. Miley and H. H. Towner 1975 6 p refs Presented at the Proc. on Nucl. Cross Section and Technique, Wash. D. C., 3 Mar. 1975 Sponsored by ERDA
(COO-2218-28; Conf-750303-51) Avail: NTIS HC $4.00

Tables and graphs of fusion reactivities (broken bracket sigma v broken bracket) are readily available for fusion in thermalized (Maxwellian) plasma using common fuels. However, plans to construct the Two-Component Torus (TCT) have created a need for reactivities to characterize fusion via high-energy beams interacting with low-temperature target plasmas. Such reactivities are derived for a variety of fuels including D yields T, D yields He-3, D yields D, T yields T, T yields He-3, and p yields B-11. Some examples of the use of these reactivities in two-component calculations are also described. Author (NSA)

N76-22063# Sandia Labs., Albuquerque, N.Mex.
AVERAGE ATOM MODEL OF PARTIAL IONIZATION, REVISITED
M. J. Clauser May 1975 18 p refs
(Contract AT(29-1)-789)
(SAND-75-0135) Avail: NTIS HC $4.00

The average atom model of partial ionization discussed by Zeldovich and Raizer provides an approximate solution to the Saha equation. As originally derived the model contains several approximations and ad hoc assumptions and violates one of the Maxwell equations of thermodynamics. An alternate derivation of the model is presented which is thermodynamically correct and which reduces the number of assumptions and approximations. Several variations on the basic model are then discussed wherein accuracy can be traded for ease of computation.
Author (NSA)

N76-22064# Oak Ridge National Lab., Tenn.
HELICAL INSTABILITY OF A PLASMA COLUMN
N. M. Zueva and L. S. Solovev 1974 10 p Transl. into ENGLISH from Russian Preprint no. 89, 1974
(ORNL-TR-4028) Avail: NTIS

A linear and nonlinear theory of helical instability for a plasma cylinder is treated in frames of ideal magnetohydrodynamics. The nonlinear stage of the instability growth is considered quasistatically, i.e., the temporal sequence of states of a system is represented by a chain of properly chosen helical equilibrium configurations. If the states are connected by conservation laws, the system under consideration performs periodical oscillations. A feature of the nonlinear stage of the process consists in formation of magnetic surfaces with a fibrous structure.
Author (NSA)

N76-22065# Princeton Univ., N.J. Plasma Physics Lab.
ORTHOGONAL CONDUCTIVITY OF A TOROIDAL PLASMA
Allen H. Boozer Sep. 1975 26 p refs
(Contract E(11-1)-3073)
(MATT-1143) Avail: NTIS HC $4.00

The orthogonal conductivity of a toroidal plasma is calculated in the fluid regime. If the damping time for toroidally directed angular momentum is tau/sub N/, the orthogonal conductivity is shown to be sigma/sub perpendicular to/equals (rho sq c sq b sub p)/tau/sub n/ for large tau/sub N/. Here rho is the mass density, c the speed of light and B/sub p the poloidal component of the magnetic field. For large tau/sub N/, the flow induced by the orthogonal electric field is almost purely toroidal and of magnitude. Author (NSA)

N76-22066# Oak Ridge National Lab., Tenn.
NONLINEAR MHD INSTABILITIES IN ELONGATED CYLINDERS
G. Bateman, H. R. Hicks, and J. W. Wooten 1975 4 p refs Presented at the 3d Topical Conf. on Pulsed High Beta Plasmas, Abingdon, England
(Conf-750944-16) Avail: NTIS HC $4.00

The nonlinear evolution of fixed-boundary instabilities was studied using a 3-D ideal magnetohydrodynamic computer simulation. The effect of elongation and peaked profile is studied. It is found that the dominant process is convection around essentially fixed velocity vortex cells. Author (NSA)

N76-22067# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Dept. de Physique du Plasma et de la Fusion Controlee.
DIFFUSION OF PARTICLES OF PLASMA CONFINED DUE TO COLLISIONLESS DRIFT WAVES Ph.D. Thesis - Cairo Univ., Egypt
Nawal Zakaria Abdel-Shadid Mar. 1975 52 p refs
(EUR-CEA-FC-765) Avail: ERDA Depository Libraries HC $5.75

The cross-field transport of particles associated with collisionless drift waves, arising in a magnetically confined plasma was measured. The measurements were compared with the numerical results derived from the linear dispersion relation. Author (NSA)

N76-22068# Illinois Univ., Urbana. Gaseous Electronics Lab.
POTENTIAL WELL FORMATION IN ELECTROSTATIC CONFINEMENT DEVICES Technical Progress Report, 1 Sep. 1974 - 1 Sep. 1975
B. E. Cherrington and J. T. Verdeyen 1975 66 p refs Sponsored by ERDA
(COO-2323-4) Avail: NTIS HC $6.50

The overall goal is to evaluate the feasibility of using inertial electrostatic forces to confine energetic plasmas capable of sustaining fusion reactions. A continuation of the theoretical studies has shown that highly energetic ions can be confined in larger spherical devices operating at high voltages and currents. A larger experimental device was designed to test the theoretical predictions, and this device is under construction. Additional studies on a smaller spherical device were performed in order to determine the time of formation, time of decay, and stability of the negative potential wells and the multiple potential wells.
Author (NSA)

N76-22069# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
ANNUAL STATUS REPORT, 31 DECEMBER 1974
Aug. 1975 80 p refs Sponsored in part by Neth. Organ. for Pure Sci. Res. (ZWO) and EURATOM
Avail: NTIS HC $5.00

Activities cover nuclear fusion experiments. Three toroidal experiments are now in operation. SPICA, a small aspect ratio toroidal screw pinch is used to investigate the effect of force-free currents in the outer regions of the pinch on the equilibrium and stability of the plasma. In RINGBOOG a study is made of the influence of a cold neutral gas envelope on a Tokamak-like discharge. TORTURE was designed to expand on turbulent treating results obtained in a linear experiment. Results for these experiments are summarized. ESA

N76-22070# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
EXPERIMENTS WITH A LARGE SIZED HOLLOW CATHODE DISCHARGE FED WITH ARGON, PART 2 Annual Report, 1974
F. Boeschoten, D. J. Kleijn, R. Komen, W. F. H. Merck, A. F. C. Sens, A. W. M. Vanlersel, and A. H. M. VanDeVen Jun. 1975 78 p refs Prepared jointly with EURATOM
(TH-75-E-59; ISBN-90-6144-059-9) Avail: NTIS HC $5.00

Results of measurements made on the positive column of a large sized hollow cathode discharge in argon are presented. The plasma is in a stationary state and fully ionized (though charge exchange collisions with neutral particles are still of importance). A given set of discharge parameters corresponds to a certain set of plasma parameters and the phenomenal relations between the plasma- and the gas discharge parameters are shown. It turns out that the experimentally determined relationship between plasma parameters is properly described by the momentum equations of ions and electrons. The angular mass velocity is heavily sheared, and equals the sum of the diamagnetic- and electric drift velocity of the ions. The conductivity of the plasma is normal. The diffusion of the plasma through the magnetic field is in agreement with the classical diffusion theory and definitely not by mechanisms as suggested by Bohm (drain diffusion) and Simon (ion-ion collisions). As predicted by Kaufman the radial electric field points inward, but near the core of the arc it is four times larger than expected from ion-ion collisions alone. The strong coherent low frequency oscillations which are generated spontaneously in the plasma are identified as m = 1 modes, but their origin is not quite clear yet - probably they are resistive drift oscillations. They may affect the radial density profile somewhat, but the plasma confinement is not deteriorated (the confinement time is about 2 ms). Author (ESA)

N76-22071# Naval Research Lab., Washington, D.C.
DEVELOPMENT OF A LAGRANGIAN QUASI-STATIC TWO-DIMENSIONAL TOKAMAK MODEL Final Report
J. H. Gardner and J. P. Boris Nov. 1975 19 p refs
(NRL Proj. H02-37)
(AD-A018068; NRL-R-3152) Avail: NTIS CSCL 20/9

Progress in the development of a 2D Lagrangian numerical model for computing the time dependent quasi-static evolution of a Tokamak discharge is discussed. A triangular tessellation of the computational domain is introduced which possesses arbitrary vertex connectivity and which, therefore, is not subject to all of the usual limitations of rectangular-grid calculations.
Author (GRA)

N76-22072# Naval Research Lab., Washington, D.C.
ELECTROSTATIC TRAPPING AND THE LINEAR AND NONLINEAR EVOLUTION OF DISSIPATIVE TRAPPED ELECTRON INSTABILITIES
Edward Ott and Wallace M. Manheimer Nov. 1975 28 p refs
(NRL Proj. H02-37)
(AD-A018023; NRL-MR-3153) Avail: NTIS CSCL 20/3

Three problems related to the effect of electrostatic trapping on dissipative trapped electron instabilities are investigated: (1) the linear theory of the dissipative trapped electron mode for the case in which there is both a magnetic well and an electric well (or anti-well), (2) the nonlinear stability of a drift wave (in a straight constant magnetic field) whose amplitude is large enough to trap electrons, and (3) the nonlinear saturation of the dissipative trapped electron mode in a Tokamak-type magnetic well via the mechanism of electric trapping and detrapping by wave electrostatic potential perturbations along B. Author (GRA)

N76-22073# Naval Research Lab., Washington, D.C.
MODE COUPLING STABILIZATION OF THE DISSIPATIVE TRAPPED ELECTRON INSTABILITY
Wallace M. Manheimer, K. R. Chu (Sci. Appl., Inc.), Edward Ott (Cornell Univ.), Jay P. Boris, and J. D. Callen (Oak Ridge Natl. Lab.) Nov. 1975 27 p refs Sponsored in part by ERDA
(NRL Proj. H02-37)
(AD-A018051; NRL-MR-3157) Avail: NTIS CSCL 20/9

The nonlinear theory of one-dimensional mode-coupling stabilization for the dissipative trapped electron instability is presented. This nonlinear process couples unstable modes at low wave number to damped waves at high wave number. The regions of parameter space in which this process is applicable are carefully specified, and the saturated wave spectra and anomalous transport coefficients are calculated numerically for a range of parameters of interest for large Tokamak operation. The transport coefficients calculated are expected to be upper bounds and yet are appreciably smaller than the unusual (gamma/k squared) estimated in moderate and high temperature regimes. GRA

N76-22074# Illinois Univ., Urbana.
CTR PLASMA ENGINEERING STUDIES Progress Report, 1 Sep. 1974 - 31 Aug. 1975
George H. Miley 1 Jun. 1975 10 p refs
(Contract AT(11-1)-2218)
(COO-2218-39) Avail: NTIS HC $4.00

This research was concerned with three main subtasks: (1) neutral beam injection and charge exchange losses for mirror systems, (2) two-component plasma calculations and fusion burn simulation, and (3) studies of special problems such as cyclotron effects related to the use of advanced fusion fuels. NSA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N76-22075*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXOELECTRON EMISSION FROM A CLEAN, ANNEALED MAGNESIUM SINGLE CRYSTAL DURING OXYGEN ADSORPTION
John Ferrante 1976 20 p refs Presented at Ann. Meeting of the Am. Soc. of Lubrication Engr., Philadelphia, 10-14 May 1976
(NASA-TM-X-71902; E-8599) Avail: NTIS HC $3.50 CSCL 20B

Exoelectron emission was observed from a clean, annealed Mg (0001) surface during oxygen and chlorine adsorption at pressures of 6.5x10 0.00001- N/sq m and lower. the studies were performed in an ultrahigh vacuum system. The crystals were cleaned by argon ion bombardment and annealed at 300 C. Auger electron spectroscopy was used to verify surface cleanliness, and low energy electron diffraction was used to verify that the surface was annealed. The emission was found to be oxygen arrival rate dependent. Two peaks were observed in the electron emission with exposure. Evidence is presented that the formation of the second peak corresponds to oxidation of the Mg surface. No emission was observed from clean aluminum during adsorption. Results verify that electron emission occurs from a strain free surface simply upon adsorption of oxygen. A qualitative explanation for the mechanisms of emission in terms of chemical effects is presented. Author

N76-22076*# Grambling State Univ., La. Dept. of Physics.
STUDY OF THE EXTRA-IONIC ELECTRON DISTRIBUTIONS IN SEMI-METALLIC STRUCTURES BY NUCLEAR QUADRUPOLE RESONANCE TECHNIQUES Semiannual Status Report
A. Narasimha Murty 5 Apr. 1976 18 p refs
(Grant NGR-19-011-016)
(NASA-CR-146818; SASR-6) Avail: NTIS HC $3.50 CSCL 20L

A straightforward self-consistent method was developed to estimate solid state electrostatic potentials, fields and field gradients in ionic solids. The method is a direct practical application of basic electrostatics to solid state and also helps in the understanding of the principles of crystal structure. The necessary mathematical equations, derived from first principles, were presented and the systematic computational procedure developed to arrive at the solid state electrostatic field gradients values was given. Author

N76-22077*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SURFACE PHOTOVOLTAGE SPECTROSCOPY APPLIED TO GALLIUM ARSENIDE SURFACES Interim Release
Charles E. Bynik Dec. 1975 23 p refs
(NASA-TM-X-71958) Avail: NTIS HC $3.50 CSCL 20L

The experimental and theoretical basis for surface photovoltage spectroscopy is outlined. Results of this technique applied to gallium arsenide surfaces, are reviewed and discussed. The results suggest that in gallium arsenide the surface voltage may be due to deep bulk impurity acceptor states that are pinned at the Fermi level at the surface. Establishment of the validity of

this model will indicate the direction to proceed to increase the efficiency of gallium arsenide solar cells. Author

N76-22078*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MAGNETIZATION AND MAGNETIC SUSCEPTIBILITIES OF GdH3, HoH3, ErH3 AND YbH3
D. J. Flood 1976 14 p refs Presented at the Am. Phys. Soc. Meeting, Atlanta, 29 Mar. - 2 Apr. 1976
(NASA-TM-X-71897; E-8683) Avail: NTIS HC $3.50 CSCL 20L

The magnetic susceptibility of powdered samples of HoH3, ErH3, GdH3 and YbH3 have been measured in the temperature range from 4.2 to 1.2 K. Two broad, local maxima are observed in the variation of chi versus T for GdH3, with maxima in (delta chi delta T) versus T at 1.8 K and 3.3 K. The inverse susceptibilities for HoH3 and ErH3 both obey a Curies-Weiss law over a limited range (4.2 to 2.6K and 4.2 to 2 K respectively) with values for the Weiss constant of -4.25 K and -1.11 K, and effective moments of 8.6 and 7.7 Bohr magnetons respectively. The susceptibility of YbH3 is independent of temperature over the range investigated. High-field magnetization measurements yield extrapolated saturation moments of 7.0 + or - 0.25 Bohr magnetons/ion for GdH3, 6.1 + or - 0.2 Bohr magnetons/ion for HoH3 and 3.74 + or - 0.11 Bohr magnetons/ion for ErH3. In addition, ErH3 exhibits a van Vleck paramagnetism in the high field region. Author

N76-22079*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MAGNETIC FIELD GENERATED RESISTIVITY MAXIMUM IN GRAPHITE
John A. Wollam, L. W. Kreps, Maria Rojeski, Terje Vold, and Robert Devaty 1976 19 p refs Presented at the Meeting of the Am. Phys. Soc., Atlanta, 29 Mar. - 1 Apr. 1976
(NASA-TM-X-71910; E-8705) Avail: NTIS HC $3.00 CSCL 20L

In zero magnetic field, B, the electrical resistivity, rho(O,T) of highly oriented pyrolytic (polycrystalline) graphite drops smoothly with decreasing T, becoming constant below 4 K. However, in a fixed applied magnetic field B, the resistivity rho(B,T) goes through a maximum as a function of T, with larger maximum for larger B. The temperature of the maximum increases with B, but saturates to a constant value near 25 K (exact T depends on sample) at high B. In single crystal graphite a maximum in rho(B,T) as a function of T is also present, but has the effects of Landau level quantization superimposed. Several possible explanations for the rho(B,T) maximum are proposed, but a complete explanation awaits detailed calculations involving the energy band structure of graphite, and the particular scattering mechanisms involved. Author

N76-22080# Science Research Council, Chilton (England). Rutherford Lab.
SUPERCONDUCTING MATERIALS: SOME RECENT DEVELOPMENTS
M. N. Wilson 1975 14 p refs Presented at 5th Intern. Conf. on Magnet Technol., Frascati, Italy, 21 Apr. 1975
(RL-75-060; Conf-750438-7) Avail: ERDA Depository Libraries HC $4.00

Four subject areas in the area of magnet conductors which have seen significant changes in recent years are presented. They are: (1) ac losses, (2) stability, (3) multifilamentary Nb3Sn, and (4) multifilamentary V3Ga. Several applications are now being considered in which a small amplitude ac field is superposed on a larger dc field; fine filaments may not always give the lowest hysteresis loss under these conditions. The theory of self field instability has recently been improved and extended to the point where it can provide a good picture of the instability process under realistic thermal conditions. Some points of disagreement with experimental observation remain; however, a possible explanation is offered for this. Multifilamentary Nb3Sn and V3Ga are now reaching the stage of meriting serious consideration as fully practical magnet conductors. The remaining problems of production and utilization are being solved and composites have been tested with at least twice the overall current density of filamentary NbTi at all field levels. Author (NSA)

N76-22081# Ames Lab., Iowa.
SUPERCONDUCTIVITY AND THE KONDO EFFECT IN QUENCH-CONDENSED FILMS CONTAINING CERIUM Ph.D. Thesis
R. J. Delfs Feb. 1975 124 p refs
(Contract W-7405-Eng-82)
(IS-T-659) Avail: NTIS HC $9.25

The superconductivity transition temperature, T/sub c/, and the Kondo resistance anomaly were studied in flash-evaporated quench-condensed thin films of Pb(Ce) and In(Ce). In both alloys, cerium caused a uniform depression of T/sub c/, with a slope of 1 K/at. percent Ce. Measurements after low-temperature annealing and measurements on samples of different residual resistivities, rho(0) showed T/sub c/ to be relatively insensitive to structural disorder. Approximately half of the samples showed a Kondo effect with a resistivity rise proportional to log T at low temperatures. For the In(Ce) system the rise in resistivity over one temperature decade, DELTA rho, equalled .03 mu OMEGA cm/at. percent Ce relatively independent of structural disorder. For the Pb(Ce) system, however, DELTA rho equals 3 mu OMEGA cm/at. percent Ce for disordered films having rho(0) equals 400 mu OMEGA cm, but DELTA rho equals .015 mu OMEGA cm/at. percent Ce for films having rho(0) equals 100 mu OMEGA cm. Author (NSA)

N76-22082# Danish Atomic Energy Commission, Risoe.
GROWING SINGLE CRYSTALS OF LITHIUM
M. M. Beg Apr. 1975 12 p refs
(RISO-M-1791) Avail: ERDA Depository Libraries HC $4.00

Large scale crystals of lithium-7 were grown by the Bridgman method. Crytals were grown in sealed stainless steel thin walled containers, which could be used directly for the inelastic neutron scattering lattice dynamics experiments. The mosaic spread of the crystals varied between 25ft and 45ft. Author (NSA)

N76-22083# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
ENHANCED SUPERCONDUCTIVITY AND LATTICE INSTABILITY IN Nb-Rh ALLOYS
W. L. Johnson and S. J. Poon Jan. 1975 11 p
(Contract AT(04-3)-822)
(CALT-822-69) Avail: NTIS HC $4.00

Superconductivity with transition temperature above 10 K has been observed in a new Nb-Rh intermediate phase. The structure of this new phase is related to that of the sigma-phase but with higher symmetry. Author (NSA)

N76-22084# Argonne National Lab., Ill.
ELECTRONIC ENERGY BAND STRUCTURE OF ACTINIDE METALS AND INTERMETALLICS
D. D. Koelling 1975 19 p refs Presented at the 5th Intern. Conf. on Plutonium and Other Actinides, Baden-Baden, West Germany, Sep. 1975
(Contract W-31-109-eng-38)
(Conf-750915-13) Avail: NTIS HC $4.00

The behavior of the 5f electrons as the crucial factor in determining the electronics properties of materials containing actinides is discussed. Whether these electrons will be localized or itinerant depends on the relative size of the Coulomb correlation and the near-neighbor interaction (bandwidth) terms. Evidence from optical reflectivity and de Haas-van Alphen measurements which show that the f-states are itinerant in the light actinide metals is examined. The mechanisms by which this occurs are studied, and it is shown that the dominant feature is a direct f-f interaction on neighboring sites. It is as a result of this dominance that correlations with actinide separation are found for the observed superconducting and magnetic properties. Since materials which appear as exceptions to this correlation are significant as systems where the direct f-f interaction is not the dominant term, as illustrative examples, the L1 sub 2 crystal structure materials involving uranium are discussed.
Author (NSA)

N76-22085# Mound Lab., Miamisburg, Ohio.
METAL HYDRIDE RESEARCH
10 Apr. 1975 69 p refs In Mound Laboratory Activities for the Division of Physical Research: July - December 1974
(Contract AT(33-1)-GEN-53)

(MLM-2198) Avail: NTIS HC $4.50

A new program for fundamental research on metal-hydrogen systems was initiated. The general formalism of the band theory technique to be used in the evaluation of the metal hydrides is described. The self-consistent plane wave-Gaussian method is being compared with the Hartree-Fock method on test cases of Li and LiH. An EPR spectrometer, transportable gas rack, and devices for studying kinetics of metal-hydrogen systems are described. Measurements of the magnetic moments and spin-lattice relaxation times at room temperature were for several titanium hydride samples of different stoichiometries. NSA

N76-22086# Helsinki Univ. of Technology, Otaniemi (Finland). Radio Lab.

THE EFFECTS OF DIFFUSION ON QUENCHED DOMAIN OSCILLATIONS OF A TRANSFERRED ELECTRON DEVICE

David E. Meharry 1975 20 p refs

(Rept-S-75; ISBN-951-750-537-X) Avail: NTIS HC $3.50

Analytical solutions for the domain shape were found to approximate forms of the nonlinear differential equation for excess charge carrier density with nonzero diffusion. Modifications to a previous analytical model of a Transferred Electron Device (TED) in the diffusionless case were made, yielding analytical expressions for device admittance when operating in the quenched domain mode. In spite of large changes in domain shape, TED operation is not much affected by diffusion. Author (ESA)

N76-22087# Stanford Univ., Calif. Solid-State Electronics Lab.

PREPARATION AND PROPERTIES OF Al(x)Ga(1-x)Sb FOR APPLICATION TO LUMINESCENT DEVICES Final Technical Report

Keh-Yung Cheng Aug. 1975 78 p refs

(Contract N00014-67-A-0112-0044)

(AD-A017862; SU-SEL-75-022; TR-5111-5) Avail: NTIS CSCL 20/12

The ternary phase diagram of the Al-Ga-Sb system was established in the Ga-rich region. Al(x)Ga(1-x)Sb layers with Al concentration x varying from 0.0 to 0.92 were grown on (111) oriented GaSb substrates in a Ga-rich melt using a vertical dipping liquid phase epitaxy system. The dependence of bandgap energy on Al concentration x in the mixed crystal was measured in undoped layers using optical absorption wavelength modulated absorption, photoluminescence and electron beam microprobe techniques at 77 and 300K. The infrared lattice vibration spectra of the Al(x)Ga(1-x)Sb system were studied in the reststrahlen region. Room temperature reflectance spectra were measured in a double beam mode at near normal incidence in the spectral range from 180 to 520/cm. The composition dispersion in the TO phonon branches was studied by using the random element isodisplacement (REI) model. The six-parameter REI model was found to be the best approach in describing the Al(x)Ga(1-x)Sb system. GRA

N76-22088# Harry Diamond Labs., Adelphi, Md.

RARE EARTH ION-HOST CRYSTAL INTERACTIONS. 3: THREE-PARAMETER THEORY OF CRYSTAL FIELDS

Richard P. Leavitt, Clyde A. Morrison, and Donald E. Wortman Jun. 1975 45 p refs

(DA Proj. 1T1-61102-A-34A)

(AD-A017849; HDL-TR-1673) Avail: NTIS CSCL 20/2

A systematic approach in selecting solid-state materials that offer promise as new lasers with predetermined characteristics is of fundamental importance. Reliable predictions of the energy levels and transition probabilities of a laser active ion in a given host would greatly facilitate this goal. The three-parameter theory of crystal fields is used to derived crystal-field parameters for the first rare-earth series, lanthanides, in CaWO4. The parameters q and eta of the theory describe covalent effects in the host lattice: q represents the effective oxygen charge, and eta represents the effective oxygen-tungsten distance. The third parameter tau represents the expansion of the radial 4f wavefunction from its Hartree-Fock value. Values of tau are found for the ions Nd(3+), Tb(3+), Dy(3+), Ho(3+), Er(3+), and Tm(3+), and are determined for the other rare earths by a linear fit. Energy levels and ground state g-values are calculated using the derived crystal-field parameters. GRA

N76-22089# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

WORK-HARDENING AND STRAIN RATE SENSITIVITY OF FLOW STRESS IN HIGH PURITY ICE SINGLE CRYSTALS Research Report

V. R. Parameswaran Oct. 1975 16 p refs

(DA Proj. 1T1-61102-B-52A)

(AD-A018015; CRREL-RR-342) Avail: NTIS CSCL 20/2

Single crystals of high purity ice deformed by uniaxial compression on an Instron machine showed remarkable work-hardening after about 8% strain. By changing the strain rate during compression tests in the plastic region of the stress-strain curve, an apparent activation volume V^* and a dislocation mobility exponent m were calculated from the strain rate sensitivity of flow stress. The large work-hardening and the rapid increase in the value of m beyond about 10% strain indicate that the plastic flow in this region is controlled by dislocation intersections and nonconservative motion of jogs. Author (GRA)

N76-22090# Stanford Univ., Calif. Dept. of Applied Mechanics.

TORSIONAL VIBRATION OF A HOLLOW CYLINDER WITH PERIODIC STRUCTURE

R. K. Kaul and G. Herrmann Aug. 1975 32 p refs

(Contract N00014-67-A-0112-0065; Grant AF-AFOSR-2669-74; AF Proj. 064-525)

(AD-A017674; SU-DAM-75-11; AFOSR-75-1543TR) Avail: NTIS CSCL 20/2

The theory of torsional vibrations of hollow cylinder, with a periodic structure of elastic constants and density variation normal to the axis of the cylinder is developed in terms of Floquet waves. Floquet waves are quasi-periodic, whose amplitude profile has the same periodicity as that of the material and thus repeats after traveling a complete cell of the cylinder. Using Floquet theory, the dispersion spectrum is obtained for time-harmonic waves propagating normal to the laminations. It is shown that the dispersion spectrum has a banded structure, consisting of passing bands and stopping bands. Some special cases, in which the wave profiles have simple forms are also considered. Also concluded in the analysis is the study of the mode shapes at the two ends of the zone. Author (GRA)

N76-22091# Colorado State Univ., Fort Collins. Dept. of Physics.

ELECTRONIC TRANSPORT NEAR THE SURFACE OF InSb FILMS

A. Zemel and J. R. Sites 10 Nov. 1975 22 p refs

(Contract N00014-75-C-0770; NR Proj. 372-305)

(AD-A018119; SF7) Avail: NTIS CSCL 20/12

Surface layer carrier concentrations and mobilities of n-type InSb films were separated from those of the bulk of the film through the magnetic field dependence of the Hall coefficient coupled with conventional galvanomagnetic measurements. The surface density is found to decrease when the free surface is anodized. GRA

N76-22092# Army Material Systems Analysis Activity, Aberdeen Proving Ground, Md.

EFFECTS OF HEAVY DOPING ON THE I-V CHARACTERISTICS OF SCHOTTKY BARRIER AND p-n JUNCTIONS

John F. Sheldon Jul. 1975 190 p refs

(DA Proj. 1T7-65706-M-541)

(AD-A017948; AMSAA-TR-134) Avail: NTIS CSCL 20/12

This research derives expressions which show that the current-voltage characteristics of Schottky barrier and p-n junctions are modified when doping levels are increased to degenerate levels. Such doping in these devices are extant in state-of-the-art technology for high-speed switches and highly stable current/voltage regulators. The experimental items for this research were Schottky-Barrier (Al n - Si) zener diodes. Good agreement was established between the degenerate theory and the more highly doped Schottky barrier samples. GRA

N76-22093# Missouri Univ., Columbia. Coll. of Engineering.

STUDIES OF THE INTERACTION OF X-RAYS WITH LIQUIDS, GASES WITH SOLID SURFACES AND THE PROPERTIES OF LIQUIDS, GASES AND PLASMA SYSTEMS Final Report, 1 Sep. 1967 - 31 Aug. 1973

Truman S. Storvick Sep. 1975 28 p refs
(Contract DAAA13-68-C-0033)
(AD-A016975) Avail: NTIS CSCL 07/4

The project THEMIS contract DAAA13-68-C-0033 effort was directed toward the experimental determination of the thermophysical properties of fluids. Interpretation of these experiments and the search for theoretical and empirical schemes for predicting and correlating the results were also a major part of the effort. The work includes the study of thermal accommodation of gases on clean metal surfaces; small angle X-ray scattering by suspensions and gases in the vapor-liquid critical region; shock tube studies of plasma systems dilute in charged particles; pressure-volume-temperature-composition studies of liquids; and properties of polyatomic gases. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

No abstracts in this category.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N76-22094*# Stanford Research Inst., Huntsville, Ala.
USER BENEFITS AND FUNDING STRATEGIES Executive Summary, May - Oct. 1975
N. A. Beauchamp Oct. 1975 22 p refs
(Contract NAS5-22371)
(NASA-CR-144707) Avail: NTIS HC $3.50 CSCL 05A

A three-step, systematic method is described for selecting relevant and highly beneficial payloads for the Interim Upper Stage (IUS) that will be used with the space shuttle until the space tug becomes available. Viable cost-sharing strategies which would maximize the number of IUS payloads and the benefits obtainable under a limited NASA budget were also determined. Author

N76-22095*# National Aeronautics and Space Administration, Washington, D.C.
ADP CORRESPONDENCE SYSTEM: UNSOLICITED PROPOSAL EVALUATION TRACKING APPLICATION
W. A. Greene and D. J. Goodwin Apr. 1976 97 p
(NASA-TM-X-3389) Avail: NTIS HC $5.00 CSCL 05A

A complete description of a correspondence control system, designed to be used by non-ADP clerical personnel is provided. In addition to operating instructions, sufficient design and conceptual information is provided to allow use or adaption of the system in related applications. The complete COBOL program and documentation are available. Author

N76-22096# University of Southern Calif., Los Angeles. Social Science Research Inst.
ERROR IN DECISION ANALYSIS: HOW TO CREATE THE POSSIBILITY OF LARGE LOSSES BY USING DOMINATED STRATEGIES
Detlof VonWinterfeldt and Ward Edwards 1 Apr. 1975 60 p refs
(Contract N00014-67-A-0269-0034; NR Proj. 197-021; ARPA Order 2105)
(AD-A017881; USC-001597-1-T; SSRI-RR-75-4) Avail: NTIS CSCL 05/1

This report examines some concepts, sources, and possible consequences of error in decision analysis. Recent articles on the possibilities for error in decision analysis showed that under some relatively mild assumptions deviations from optimal decision strategies or from optimal model parameters will lead only to minor losses in expected value. This 'flat maximum' property of decision analytic models applies, however, only to admissible decisions. By inadvertently selecting a dominated (inadmissible) decision, the decision maker creates the possibility for large expected losses. Usually dominance can be recognized and losses can be avoided by elimination of dominated decisions. Unfortunately, for a large class of errors the discovery of dominance is difficult if not impossible. These errors consist of failing to use information or using it inappropriately in decision strategies. The main point this report makes is that such errors can, and typically will, lead to dominated strategies, and so can lead to substantial expected losses. GRA

N76-22097# Decisions and Designs, Inc., McLean, Va.
DECISION ANALYSIS AS AN ELEMENT IN AN OPERATIONAL DECISION AIDING SYSTEM, PHASE 2 Technical Report, 1 Nov. 1974 - 31 Oct. 1975
R. V. Brown, C. R. Peterson, W. H. Shawcross, and J. W. Ulvila Nov. 1975 98 p refs
(Contract N00014-74-C-0263; NR Proj. 198-002; NR Proj. R43-03)
(AD-A018109; TR-75-13) Avail: NTIS CSCL 05/1

Continuing decision analytic research and the initial development of several prototype decision aids, for the tactical support of naval task force commanders, are reported on in this paper. Focus is on the potential contribution of advance techniques of decision analysis as decision aids in the development of operational plans and as an action selection tool in the mission execution phase of task force operations. Nine prototype aids were specified and developed to varying degrees for use on the interactive computer graphics terminal. GRA

N76-22098# Naval Postgraduate School, Monterey, Calif.
A MULTI-RESOURCE LEVELING ALGORITHM FOR PROJECT NETWORKS M.S. Thesis
Chung Ung Lee Sep. 1975 32 p refs
(AD-A016373) Avail: NTIS CSCL 05/1

This thesis presents a modification and extension to the Burgess and Killebrew heuristic resource leveling procedure for project networks. In contrast to previous algorithms appearing in the literature, the objective function of this algorithm is the minimization of the sum of the squared errors in each time period (deviations around the mean usage) of all resources over the duration of the project. This objective function continues the search for an improved schedule beyond that of previous algorithms with their associated objective functions. One important feature is that the algorithm tends to reduce the number of periods that a resource is idle during its duration on the project. GRA

N76-22099# RAND Corp., Santa Monica, Calif.
AN ANALYST'S VIEW OF THE USES AND ABUSES OF MODELING FOR DECISION-MAKING
G. D. Brewer Jan. 1975 32 p refs
(AD-A016497; P-5395) Avail: NTIS CSCL 05/1

The report discusses the question of whether or not models, simulations, and games (MSGs) are being used to advantage by policy makers. Although these techniques are being used extensively, close inspection of much of the activity reveals a divergence between those who build MSGs and those who use them for policy making. Users are characterized as inadequately trained to know what they are buying; the experts responsible for the models are criticized for not assuming responsibility for their products. Ameliorative measures are suggested. GRA

N76-22100# Burns and McDonnell, Kansas City, Mo.
MANUFACTURER'S CATALOG DATA OF AUTOMATION AND SURVEILLANCE SYSTEMS FOR UTILITY PLANTS AT FORT LEONARD WOOD, MISSOURI, VOLUME 2
30 Apr. 1975 253 p
(Contract DACA45-74-C-D108)
(AD-A016945; Rept-74-051-Vol-2) Avail: NTIS CSCL 05/1

Automation and surveillance systems for utility plants at Fort Leonard Wood, Missouri are discussed. This report contains manufacturer's catalog data. GRA

N76-22101# Dikewood Corp., Albuquerque, N.Mex.
CONCEPT OF A MANAGEMENT INFORMATION SYSTEM FOR TESPO Final Report
B. G. VanBlaricum and June G. Brenton Oct. 1975 45 p refs
(Contract F29601-74-C-0022)
(AD-A016452; DC-TR-1242-1; AFSWC-TR-75-5) Avail: NTIS CSCL 05/1

In a recent survey of available Management Information Systems, three systems that can most nearly fulfill the requirements of the Test and Evaluation System Program Office (TESPO) were selected for detailed investigation. The results of the survey and study are given in this report. The conclusion is drawn that the TESPO should select one of the three for implementation to assist with management of the Near-Term COR development and that the operating MIS be improved as experience is gained through operation and methods of improvement are further explored. GRA

N76-22102# Naval Postgraduate School, Monterey, Calif.
MANPOWER PLANNING MODELS, 3. LONGITUDINAL MODELS
R. C. Grinold and K. T. Marshall Aug. 1975 90 p refs
(AD-A016440; NPS-55MT5081) Avail: NTIS CSCL 05/9

This is the third in a series of reports on manpower planning models. The emphasis in this report is on the formulation, theory, and application of longitudinal models. The concepts of chain flows are introduced and exploited in a number of applications. GRA

N76-22103# Office of Management and Budget, Washington, D.C. Study Committee on Policy Management Assistance.
STRENGTHENING PUBLIC MANAGEMENT IN THE INTERGOVERNMENTAL SYSTEM: A REPORT PREPARED FOR OFFICE OF MANAGEMENT AND BUDGET BY THE STUDY COMMITTEE ON POLICY MANAGEMENT ASSISTANCE
1975 72 p refs Sponsored by NSF
(PB-248334/5; NSF/RA/G-75-023) Avail: NTIS HC $4.50 CSCL 05A

This report is the second of three reports by an interagency study committee. The objectives of the committee were to develop an inventory of federal policies and programs related to the policy management capacity of state and local governments, to identify the needs of state and local governments in policy management areas, and to assess the adequacy of the resources of the Federal government that bear on these needs. This report is designed to focus public debate on issues of public management and intergovernmental policy and program relationships. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N76-22104*+ National Aeronautics and Space Administration, Washington, D.C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY. SECTION 1: ABSTRACTS
Jan. 1976 72 p
(NASA-SP-7039(08)-Section-1) Avail: NTIS HC $3.00 CSCL 05B

This bibliography is issued in two sections; abstracts and indexes. The Abstract Section cites 180 patents and applications for patents introduced into the NASA scientific and technical information system during the period of July 1975 through December 1975. Each entry in the Abstract Section consists of a citation, an abstract, and in most cases, a key illustration selected from the patent or application for patent. The index Section contains entries for 2,905 patents and applications for patent citations covering the period May 1969 through December 1975. The Index Section contains five indexes -- subject, inventor, source, number and accession number. Author

N76-22105*+ National Aeronautics and Space Administration, Washington, D.C.
NASA PATENT ABSTRACTS BIBLIOGRAPHY: A CONTINUING BIBLIOGRAPHY. SECTION 2: INDEXES
Jan. 1976 502 p refs
(NASA-SP-7039(08)-Section-2) Avail: NTIS HC $5.00 CSCL 05B

This bibliography is issued in two sections: Section 1 - Abstracts, and Section 2 - Indexes. This issue of the Abstract Section cites 180 patents and applications for patents introduced into the NASA scientific and technical information system during the period July 1975 through December 1975. Each entry in the Abstract Section consists of a citation, an abstract, and, in most cases, a key illustration selected from the patent or application for patent. This issue of the Index Section contains entries for 2,905 patents and applications for patent citations covering the period May 1969 through December 1975. The Index Section contains five indexes -- subject, inventor, source, number, and accession number. Author

N76-22106*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Technical Information and Documentation Div.
THE LEVELS OF EDIT
Robert VanBuren, Mary Fran Buehler, and Doris Wallenbrock, ed. Mar. 1976 33 p refs
(Contract NAS7-100)
(NASA-CR-146584; JPL-SP-43-28) Avail: NTIS HC $4.00 CSCL 05B

The editorial process is analyzed, and five levels of edit are identified. These levels represent cumulative combinations of nine types of edit: (1) coordination, (2) policy, (3) integrity, (4) screening, (5) copy clarification, (6) format, (7) mechanical style, (8) language, and (9) substantive. The levels and types of edit, although developed for specific use with external reports at the Jet Propulsion Laboratory, cover the general range of technical editing, especially as it applies to an in-house technical publications organization. Each type of edit is set forth in terms of groups of actions to be performed by the editor. The edit-level concept has enhanced understanding and communication among editors, authors, and publications managers concerning the specific editorial work to be done on each manuscript. It has also proved useful as a management tool for estimating and monitoring cost. Author

N76-22107*# National Aeronautics and Space Administration, Washington, D.C.
INFORMATION MANAGEMENT, TODAY AND TOMORROW
Harold E. Pryor [1975] 5 p Presented at the Federal Govt./Kodak Symp., Williamsburg, Va., 14 Jan. 1976
(NASA-TM-X-74111) Avail: NTIS HC $3.50 CSCL 05B

Current problems and future trends in information management are briefly summarized in relation to scientific and technical information management systems and management of management information (planning, marketing, and operations). J.M.S.

N76-22108# Informatics, Inc., Rockville, Md.
SOVRaD, A DIGEST OF RECENT SOVIET R AND D ARTICLES, VOLUME 1, NUMBER 10, OCTOBER 1975
S. G. Hibben, L. Boylan, J. Kourilo, B. Shresta, and M. Ness Oct. 1975 17 p
(Contract MDA903-76-C-0099; DARPA Order 3097)
(AD-A017867) Avail: NTIS CSCL 05/2

Contents: Laser effect on superconductivity; IR to visible conversion; Dynamic holography; Possible nuclear-to-optical energy conversion; Laser memory; Study on TiC-ZrC compound; Failure probability of composite material; Thermonuclear reaction

from coulomb interactions; Magnetoplasma compressor study; Uniform plasma cylinder; Review of plasma diagnostics; Scanning of plasma interferograms; MHD generator used for seismic sounding; Isotope separation by supersonic flow; Tests of OSA-3-600 undersea research vehicle continuing; New type of Soviet research vessel built by Finland; Cavitation statistics; Hot probe current meter; Thermal sensor for turbulent flow; Dolphin discrimination of targets; Evaluation of dolphin echo-ranging; Satellite radiometry of earth; Computers to design computers; Recent publications. GRA

N76-22109# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
CONSTRAINED INFORMATION THEORETIC CHARACTERIZATIONS IN CONSUMER PURCHASE BEHAVIOR
A. Charnes (Texas Univ., Austin), W. W. Cooper, and D. B. Learner (Market Res. Corp. of Am.) Jul. 1975 22 p refs
(Contracts N00014-75-C-0621; N00014-75-C-0569)
(AD-A018112; RR-371) Avail: NTIS CSCL 05/3

The analysis called SAND DABS which has had a long history of use in consumer purchase behavior (including brand switching) at MRCA and elsewhere, is here given a constrained information theoretic characterization. This is made possible by recent developments in optimization and duality which are precise and general. That is, these developments generalize the classical relations between information theory and statistics as previously established in very precise forms by Kullback-Leibler (and others). Contacts with geometric programming in an extended form along with other recent developments in optimization and duality are also supplied and a way is thereby opened for unifying many apparently separate approaches to market analysis. GRA

N76-22110# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
THE INFORMATIONAL DIFFERENCES BETWEEN THE DEPARTMENT OF DEFENSE SPONSORED AND CIVILIAN-SPONSORED MANAGEMENT INFORMATION SYSTEMS M.S. Thesis
Patrick R. Ray and David W. Spicer Aug. 1975 155 p refs
(AD-A016388; SLSR-11-75B) Avail: NTIS CSCL 05/2

The Department of Defense has established an elaborate set of criteria (Cost/Schedule Control System Criteria - C/SCSC) which must be satisfied by a contractor's management information system before the award of a major weapon system contract. Meanwhile, many of these contractors continue to use much less elaborate, but not necessarily less effective, privately developed information systems to manage equivalent major non-military projects. In many cases, the contractor actually manages the weapon system contract with his own system, supporting the government system simply to satisfy contractual requirements. This research is a first step in analyzing the need for such an elaborate DOD criteria. GRA

N76-22111# Electric Power Research Inst., Palo Alto, Calif.
A PROPOSED EPRI EXECUTIVE SYSTEM AND DATA BASE
Lance J. Agee Nov. 1975 50 p refs
(PB-247220/7; EPRI-SR-23) Avail: NTIS HC $4.00 CSCL 18E

This report summarizes the long range objectives of the Electric Power Research Institute (EPRI) Nuclear Power Division in the area of developing a viable data base and interacting computer programs. The data base considered will contain both experimental and analytical data. The computer programs considered may be simple programs to reduce data or sophisticated computational systems for solving problems such as LOCA or reactor physics calculations of an LWR. In addressing these problems, both the type of computers available and existing executive systems were studied. Of equal importance were the type and physical locations of the potential users, EPRI, the electric utilities, and the general nuclear community at large. GRA

N76-22112# Adjutant Generals Office (Army), Washington, D.C.
STUDY OF THE ARMY PUBLICATIONS SYSTEM (STARPUBS) Final Report, 4 Feb. - 15 Nov. 1974
Robert Murphy, Donna J. Dalehite, Kenneth L. Denton, Henry H. Ehrenhaft, and Donald R. Griffith Jan. 1975 116 p
(AD-A008274) Avail: NTIS CSCL 05/2

The mission of the STARPUBS Study was to provide documentation of the Army publications system for future use in developing a new system identification of problem areas and any solutions developed prior to completion of the study. The team also began development of an overall systems redesign. A new initial distribution system is outlined which provides for the centralized identification of user needs. Alternative systems for functional assignments among the three physical components of the Publications Directorate (The HQ, and the two AG Publications Centers) were studied. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N76-22113# Wisconsin Univ., Madison. Mathematics Research Center.
POLICY AND PRICE STABILITY IN THE VON NEUMANN MODEL OF A CLOSED ECONOMY
Stephen M. Robinson Sep. 1975 20 p
(Contract DAAG29-75-C-0024)
(AD-A017961; MRC-TSR-1496) Avail: NTIS CSCL 05/3

The author shows that a necessary and sufficient condition for stability of the set of feasible technologies and growth factors, or of the set of feasible price systems and interest factors, in a von Neumann model is that there exist no equilibria in which the total output of the economy is without value. GRA

N76-22114# Scientific Software Corp., Denver, Colo.
ECONOMIC EVALUATION MANUAL Final Report
Sep. 1975 337 p refs
(Contract DI-14-08-0001-13926)
(PB-247640/6; USGS-CD-75-003) Avail: NTIS HC $10.00 CSCL 05C

The bases for and methods of performing economic evaluations of petroleum and natural gas prospect and producing projects are presented in a wholly tutorial format. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N76-22115# Committee on Appropriations (U. S. Senate).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, AND CERTAIN INDEPENDENT AGENCIES APPROPRIATIONS FOR FISCAL YEAR 1977. PART 1: JUSTIFICATIONS
Washington GPO 1976 1072 p refs Hearings before a subcomm. of the Comm. on Appropriations, 94th Congr., 2d Sess., 1976
(GPO-65-490) Avail: Comm. on Appropriations

Federal budgets are outlined for programs in the following United States Government agencies: (1) Department of Housing and Urban Development, (2) American Battle Monuments Commission, (3) Consumer Products Safety Commission, (4) Department of Defense-Civil, (5) Environmental Protection Agency, (6) Council on Environmental Quality (7) General Services Administration, (8) Office of Consumer Affairs, and (9) National Aeronautics and Space Administration. Programs and programs management for the various agencies are discussed. J.R.T.

N76-22116# Committee on Appropriations (U. S. Senate).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, AND CERTAIN INDEPENDENT AGENCIES APPROPRIATIONS FOR FISCAL YEAR 1977. PART 2: JUSTIFICATIONS
Washington GPO 1976 1106 p Hearings before a subcomm. of the Comm. on Appropriations, 94th Congr., 2d Sess., 1976
(GPO-65-490) Avail: Comm. on Appropriations

Federal budgets are outlined for programs in the following

United States Government Agencies: (1) National Science Foundation, (2) Selective Service System, (3) Veteran's Administration, and (4) Federal Home Loan Bank Board. Programs and program management for the various agencies are discussed. J.R.T.

N76-22117# Committee on Appropriations (U. S. House).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, INDEPENDENT AGENCIES APPROPRIATIONS FOR 1977. PART 2: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington GPO 1976 934 p refs Hearings before a subcomm. of the Comm. on Appropriations, 94th Congr., 2d Sess., 18 Feb. 1976
(GPO-68-671) Avail: Comm. on Appropriations

Congressional hearings dealing with the proposed FY 1977 appropriations for the National Aeronautics and Space Administration were reported. Y.J.A.

N76-22118# Federal Energy Administration, Washington, D.C. Office of Environmental Programs.
NATURAL GAS EMERGENCY STANDBY ACT OF 1975 Draft Environmental Impact Statement
Nov. 1975 314 p refs
(PB-247306/4; FEA/D-75/573) Avail: NTIS HC $9.75 CSCL 21D

The purpose of the statement is to describe and analyze the environmental and energy impacts that would result from the implementation of the proposed legislation or from alternatives to that legislation. Background on the natural gas shortage, descriptions of proposed legislation concerning natural gas, a description of the natural gas situation, a description of the environment affected and impact methodology, energy and environmental impacts of the proposed legislation concerning natural gas, adverse environmental impacts, short-term uses of the environment and long-term productivity, alternatives to proposed natural gas legislation, and commitment of natural gas resources are included. GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N76-22119# Office of Naval Research, London (England).
TECHNOLOGY TRANSFER, A REPORT ON THE NATO ADVANCED STUDY INSTITUTE, LES ARCS, BOURG SHINT MAURICE, FRANCE, 1975 Conference Report, Jun. - Jul. 1975
Robert F. Lopina and James H. Schulman 29 Oct. 1975 18 p
(AD-A018063; ONRL-C-17-75) Avail: NTIS CSCL 05/1

This report summarizes most of the papers given at a two-week meeting on technology transfer (TT). The meeting dealt with TT theory, military/public sector TT, and industrial sector TT, including the role of industry in TT to lesser-developed countries. Author (GRA)

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N76-22120*# State Univ. of New York, Geneseo. Dept. of Physics and Astronomy.
A STUDY OF METEOR SPECTROSCOPY AND PHYSICS FROM EARTH-ORBIT: A PRELIMINARY SURVEY INTO ULTRAVIOLET METEOR SPECTRA Final Report
David D. Meisel Washington NASA Apr. 1976 84 p refs (NASA Order L-13631-A)
(NASA-CR-2664) Avail: NTIS HC $5.00 CSCL 03A

Preliminary data required to extrapolate available meteor physics information (obtained in the photographic, visual and near ultraviolet spectral regions) into the middle and far ultraviolet are presented. Wavelength tables, telluric attenuation factors, meteor rates, and telluric airglow data are summarized in the context of near-earth observation vehicle parameters using moderate to low spectral resolution instrumentation. Considerable attenuation is given to the problem of meteor excitation temperatures since these are required to predict the strength of UV features. Relative line intensities are computed for an assumed chondritic composition. Features of greatest predicted intensities, the major problems in meteor physics, detectability of UV meteor events, complications of spacecraft motion, and UV instrumentation options are summarized. Author

N76-22121*# Stanford Univ., Calif. Center for Radar Astronomy.
TURBULENCE EFFECTS IN RADIO OCCULTATION STUDIES OF ATMOSPHERIC SCALE HEIGHTS
Von R. Eshleman Oct. 1975 17 p refs
(Grant NGL-05-020-014)
(NASA-CR-146823; SU-TR-3208-5; SU-SEL-75-030) Avail: NTIS HC $3.50 CSCL 03A

Atmospheric scale heights derived from radio occultation measurements of a turbulent planetary atmosphere would be accurate if the average angle of refraction through the turbulent atmosphere were equal to the refraction angle for the corresponding quiescent atmosphere. These two angles are not equal (although their difference may not be large enough to cause significant error). If necessary, it should be possible to correct for the systematic error introduced by this inequality by using measurements of signal spectra to determine characteristics of the turbulence. Sensitive dual-frequency measurements could help define the effects of turbulence in future radio occultation experiments. It does not appear that the angular offset due to turbulence has been important in past experiments, although it may become significant and require corrective analysis when improved equipment is used to probe deep into turbulent atmospheres with greater measurement precision. Author

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N76-22122*# Bowling Green State Univ., Ohio. Dept. of Physics.
THE EFFECT OF SUPRATHERMAL PROTONS ON THE PHYSICAL CONDITIONS IN SEYFERT GALAXY NUCLEI II
Ronald Stoner and Roger Ptak [1975] 25 p refs
(Grant NsG-7022)
(NASA-CR-146776) Avail: NTIS HC $3.50 CSCL 03B

The radiative transfer of Ly-alpha, Ly-beta, and H-alpha in a hydrogen gas containing dust was considered with application to the nuclear gas in Seyfert galaxies. By neglecting the direct escape of line radiation and by averaging over the gas, the radiation transfer in space is suppressed and the frequency transfer only is considered. The dust degrades the line radiation via frequency-independent absorption, converting the energy to infrared luminosity. The source functions in the lines were solved, using appropriate approximations, in order to determine under what conditions the narrow component of the Balmer line radiation

from the gas can be self-absorbed and degraded without similar degradation of the broad component, which originates from the suprathermals themselves. The results are used to find self-consistent values for the temperature and ionization of the gas for various amounts of dust and various concentrations of suprathermal particles. Author

N76-22123*# California Univ., Los Angeles. Dept. of Physics.
THE EARTH'S MAGNETOSPHERE
F. V. Coroniti Mar. 1976 17 p refs
(Grants NGL-05-007-190; NSF GA-34148)
(NASA-CR-146803; PPG-258) Avail: NTIS HC $3.50 CSCL 03B

The following aspects of the earth's magnetosphere were discussed: general structure, magnetic field merging and magnetospheric convection, time-varying convection and magnetospheric substorms, magnetic storms, and comparative magnetospheres. Solar flares and the magnetospheres of Mercury, Venus, Mars, Jupiter, Saturn, and Uranus were also described. Y.J.A.

N76-22124*# Old Dominion Univ. Research Foundation, Norfolk, Va.
A STUDY OF SATELLITE REMOTE MEASUREMENTS OF STRATOSPHERIC AEROSOL AND GAS PARAMETERS USING THE SOLAR OCCULTATION TECHNIQUE Final Report, Sep. 1974 - Jan. 1976
William P. Chu (Old Dominion Univ.) Apr. 1976 40 p refs
(Grant NsG-1108)
(NASA-CR-146852; PGSTR-PH76-28) Avail: NTIS HC $4.00 CSCL 03B

Satellite remote measurements of stratospheric aerosol and ozone profiles using the solar occultation approach were analyzed based on the known properties of the atmospheric parameters. Atmospheric refraction effects which are important in this experiment were determined analytically. Different inversion techniques were developed based on inverting simulated irradiance data. It was shown that aerosol and ozone profiles in the stratosphere can be inverted from the irradiance measurements to an accuracy of better than 10 percent. Author

N76-22125*# Bowling Green State Univ., Ohio. Dept. of Physics.
ON THE INTERPRETATION OF FE 2 EMISSION PROFILES IN SEYFERT GALAXIES AND QSOs
Roger Ptak and Ronald Stoner [1975] 9 p refs
(Grant NsG-7022)
(NASA-CR-146816) Avail: NTIS HC $3.50 CSCL 03B

High-resolution spectral scans of several QSOs and Seyfert galaxies show broad Balmer lines and permitted Fe II lines in emission. It is suggested that a careful comparison of the Fe II and Balmer profiles may distinguish between the different proposed mechanisms for broadening of the lines. In particular, if the Fe II profile is much narrower that the hydrogen profile, the suprathermal particle mechanism is most likely presented. Author

N76-22126*# Arizona Univ., Tucson. Dept. of Physics.
MEAN LIVES OF SOME ASTROPHYSICALLY IMPORTANT EXCITED LEVELS IN CARBON, NITROGEN AND OXYGEN
Ming-Wen Chang and W. S. Bickel 27 Jan. 1976 24 p refs Revised Sponsored in part by ONR and NSF
(Grant NGL-03-002-017)
(NASA-CR-146853) Avail: NTIS HC $3.50 CSCL 03B

A number of astrophysically important mean lives of levels in carbon, nitrogen and oxygen were measured with the beam-foil technique. New values are reported and compared with earlier theoretical and experimental values. Direct references to astrophysical applications are listed. Author

N76-22127# Ruhr Univ., Bochum (West Germany). Astronomisches Inst.
THE X-RAY BINARY STAR HZ Her [DER ROENTGENDOPPELSTERN HZ Her]
Michael Reinhardt 1975 85 p refs In GERMAN; ENGLISH summary
(RUB-AI-3) Avail: NTIS HC $5.00

Observational data are summarized. They include X-ray pulse shape with 1.24 sec period, the 1.7 d occultation and spectroscopic period, and the 35 d activity cycle. Optical observations are discussed. A model is described for Her X-1 which accounts for magnetic accretion and the 35 d cycle. The model is based on a supercorotating activity center and can explain several features of optical behavior like wandering humps and the phase lock of the optical pulsations, as well as the disturbances of the 35 d cycle and the quiet years. ESA

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N76-22128*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FUTURE EXPLORATION OF VENUS (POST-PIONEER VENUS 1978)
Lawrence Colin, Lawrence C. Evans, Ronald Greeley, William L. Quaide, Ricard W. Schaupp, Alvin Seiff, and Richard E. Young Jan. 1976 219 p refs
(NASA-TM-X-62450; A-6132) Avail: NTIS HC $7.75 CSCL 03B

A comprehensive study was performed to determine the major scientific unknowns about the planet Venus to be expected in the post-Pioneer Venus 1978 time frame. Based on those results the desirability of future orbiters, atmospheric entry probes, balloons, and landers as vehicles to address the remaining scientific questions were studied. The recommended mission scenario includes a high resolution surface mapping radar orbiter mission for the 1981 launch opportunity, a multiple-lander mission for 1985 and either an atmospheric entry probe or balloon mission in 1988. All the proposed missions can be performed using proposed space shuttle upper stage boosters. Significant amounts of long-lead time supporting research and technology developments are required to be initiated in the near future to permit the recommended launch dates. Author

N76-22129*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
LUNSORT LIST OF LUNAR ORBITER DATA BY LAC AREA
S. Hixon 1976 411 p
(Contract NAS9-10950)
(NASA-CR-147525; LEC-7730; JSC-10853) Avail: NTIS HC $11.00 CSCL 03B

Lunar orbiter (missions 1-5) photographic data are listed sequentially according to the number (1 to 147) LAC (Lunar Aeronautical Chart) areas by use of a computer program called LUNSORT. This listing, as well as a similar one from Apollo would simplify the task of identifying images of a given Lunar area. Instructions and sample case are included. Author

N76-22130*# California Univ., Los Angeles.
LOSSY RADIAL DIFFUSION OF RELATIVISTIC JOVIAN ELECTRONS
D. D. Barbosa and F. V. Coroniti Mar. 1976 39 p refs
(Grant NGL-05-007-190)
(NASA-CR-146802; PPG-259) Avail: NTIS HC $4.00 CSCL 03B

The radial diffusion equation with synchrotron losses was solved by the Laplace transform method for near-equatorially mirroring relativistic electrons. The evolution of a power law distribution function was found and the characteristics of synchrotron burn-off are stated in terms of explicit parameters for an arbitrary diffusion coefficient. Emissivity from the radiation belts of Jupiter was studied. Asymptotic forms for the distribution in the strong synchrotron loss regime are provided. Author

N76-22131*# Smithsonian Astrophysical Observatory, Cambridge, Mass.

THE STUDY OF THE PHYSICS OF COMETARY NUCLEI Semiannual Progress Report, 1 Sep. 1975 - 29 Feb. 1976
Fred L. Whipple, Brian G. Marsden, and Zdenek Sekanina Mar. 1976 126 p refs
(Grant NsG-7082)
(NASA-CR-146847; SAPR-3) Avail: NTIS HC $6.00 CSCL 03B

A semiannual progress report describing the work completed during the period 1 September 1975 to 29 February 1976 on the physics of cometary nuclei was given. The following items were discussed: (1) a paper entitled "A speculation about comets and the earth", (2) a chapter entitled" The physics of comets" for "Reviews of Astronomy and Astrophysics", (3) continuing work on split comets, and (4) results dealing with a new application of nongravitational solar-radial forces as a measure of comet nucleus dimensions and activity. Author

N76-22132# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 375. PART 2: COMPREHENSIVE REPORTS, DATA FOR MAY-APRIL 1975 AND MISCELLANEA. EXPLANATION OF DATA REPORTS ISSUED AS NUMBER 366 (SUPPLEMENT) FEBRUARY 1975
Hope I. Leighton Nov. 1975 45 p refs
(PB-247137-375-2; SGD-375-Pt-2; NOAA-75120903) Avail: NTIS MF $2.25; National Climate Center, Federal Building, Asheville, N. C. 28801. Attn: Publications. Subscription HC $34.00/year includes part 1 (prompt reports) and part 2 (comprehensive reports), HC $18.00/year for either part. Annual supplement containing explanation is included, HC $1.40/copy for either part, HC $1.30 for extra issue CSCL 03B

This is Part II of Comprehensive reports, of Solar Geophysical Data for May 1975 - April 1975 and Miscellanea. The May 1975 data include sections on Solar Flares, Solar Radio Waves, and Magnetograms of Geomagnetic Storm. The April 1975 data include sections on Abbreviated Calendar Record, and Regional Flare Index. Miscellaneous data include a section on H Solar Flares (Standardized Data). GRA

N76-22133# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
SOLAR-GEOPHYSICAL DATA NUMBER 375. PART 1: PROMPT REPORTS. DATA FOR OCTOBER-SEPTEMBER 1975. EXPLANATION OF DATA REPORTS ISSUED AS NUMBER 366 (SUPPLEMENT) FEBRUARY 1975
Hope I. Leighton Nov. 1975 107 p
(PB-247137-375-1; SGD-375-Pt-1; NOAA-75120902) Avail: NTIS MF $2.25; HC available from Natl. Climatic Center, Attn: Publ. Federal Bldg., Asheville, N. C. 28801. Subscription $34.00/year includes Pt. 1 (prompt rept.) and Pt 2 (comprehensive rept.); $18.00/year for either part. Ann. suppl. containing explanation is included. $1.40/copy for either part; $1.30 for extra issue CSCL 03B

This is Part I of Prompt reports, of Solar Geophysical Data for October 1975 and September 1975. The October 1975 data include sections on: Alert Period, Daily Solar Indices, Solar Flares, Solar Radio Waves, Solar Wind Measurements, Spacecraft Observations, Solar X-ray Radiation, and Inferred IP Magnetic Polarities. The September 1975 data include sections on: Daily Solar Activity Centers, Sudden Ionospheric Disturbances, Solar Radio Waves, Cosmic Rays, Geomagnetic Indices, and Radio Propagation Indices. GRA

N76-22134# Centre National de la Recherche Scientifique, Verrieres-le-Buisson (France).
ULTRA-VIOLET AND VISIBLE SOLAR FLUX MEASUREMENTS ON BOARD CONCORDE Final Report
J. E. Blamont, J. P. Pommereau, and G. Souchon Jun. 1975 68 p refs
(Contract DOT-AS-20023)
(PB-247619/0; DOT-TST-75-130) Avail: NTIS HC $4.50 CSCL 04A

The objective of the experiment was to provide an absolute measurement of the visible and UV solar flux at the aircraft cruising altitude; these measurements are necessary to help interpretation of other simultaneous measurements made on the aircraft. Subsequently, analysis of the collected data showed that it was possible to enlarge the scope of the experiments by computing the absorption due to aerosols and, most importantly, to determine the local concentration of NO2. GRA

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N76-22135# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
A PRELIMINARY IDEALIZED NETWORK OF NEUTRON MONITORS FOR THE STUDY OF SOLAR MODULATION Interim Report
R. E. Gold, M. A. Shea, and D. F. Smart 26 Nov. 1975 8 p refs
(AF Proj. 8600)
(AD-A018097; AFCRL-TR-75-0603) Avail: NTIS CSCL 04/1

An idealized network of neutron monitors has been developed with asymptotic cones optimized for the study of solar modulation of cosmic rays. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N76-22136*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
OBSERVATION OF SOFT X-RAYS FROM COSMIC SOURCES Final Report
R. C. Catura and L. W. Acton 31 Mar. 1975 13 p
(Contract NASw-2660)
(NASA-CR-146799; D456228) Avail: NTIS HC $3.50 CSCL 03B

A binary X-ray source, an extended extragalactic X-ray source and several nearby stars were surveyed for X-ray emission. The energy spectrum and time structure of X-ray flux from the binary source, Her X-I, was investigated in the range from 0.15 to 6 KeV. This source was observed at a binary phase of 0.18 with the system near elongation normal to the line of sight. Intense pulsations were observed in optical emission lines near this binary phase. The spectrum and angular distribution of X-ray emission from the X-ray source in the Virgo Cluster of Galaxies, near M 87, was also observed. In addition, the stars Alpha Leo, Zeta Her, and Epsilon Vir were investigated. Epsilon Aur and Alpha Aur were also scanned. These stars were studied since there is increasing evidence that such objects may be transient sources of soft X-rays. Author

N76-22137*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Space Sciences Div.
ENERGETIC PARTICLES OF THE OUTER REGIONS OF PLANETARY MAGNETOSPHERES
Bruce T. Tsurutani, Bruce E. Goldstein, and Alexander Bratenahl 1 Mar. 1976 18 p refs
(Contract NAS7-100)
(NASA-CR-146582; JPL-TM-33-766) Avail: NTIS HC $3.50 CSCL 03B

High energy particles, with energies above those attainable by adiabatic or steady-state electric field acceleration, have been observed in and around the outer regions of planetary magnetospheres. Acceleration by large amplitude sporadic cross-tail electric fields over an order of magnitude greater than steady-state convection fields is proposed as a source of these particles. It is suggested that such explosive electric fields will occur intermittently in the vicinity of the tail neutral line in the expansive phase of substorms. Laboratory and satellite evidence are used to estimate this electric potential for substorms at earth; values of 500 kilovolts to 2 megavolts are calculated, in agreement

with particle observations. It is further suggested that these particles, which have been accelerated in the night side magnetosphere, drift to the dayside on closed field lines, and under certain interplanetary conditions can escape to regions upstream of the bow shock. Author

N76-22138*# Alabama Univ., Huntsville. School of Graduate Studies and Research.
ANGULAR SENSITIVITIES OF SCINTILLATOR SLAB CONFIGURATIONS FOR LOCATION OF GAMMA RAY BURSTS Semiannual Report, 1 Jul. - 31 Dec. 1975
John C. Gregory Feb. 1976 15 p refs
(Contract NAS8-24953)
(NASA-CR-144237) Avail: NTIS HC $3.50 CSCL 03B

Thin flat scintillator slabs are a useful means of measuring the angular location of gamma ray fluxes of astronomical interest. A statistical estimate of position error was made of two scintillator systems suitable for gamma ray burst location from a balloon or satellite platform. A single rotating scintillator with associated flux monitor is compared with a pair of stationary orthogonal scintillators. Position error for a strong burst is of the order of a few arcmin if systematic errors are ignored. Author

N76-22139*# California Univ., Berkeley. Dept. of Physics.
HIGH RESOLUTION CERENKOV AND RANGE DETECTORS FOR BALLOON-BORNE COSMIC-RAY EXPERIMENT
S. P. Ahlen, B. G. Cartwright, and G. Tarle [1975] 21 p refs
(Grant NGR-05-003-376)
(NASA-CR-146796) Avail: NTIS HC $3.50 CSCL 03B

A combination of an active Cerenkov detector and passive range detectors is proposed for the high resolution measurement of isotopic composition in the neighborhood of iron in the galactic cosmic rays. A large area (4,300 sq cm) Cerenkov counter and passive range detectors were tested. Tests with heavy ions (2.1 GeV/amu C-12, 289 MeV/amu Ar-40, and 594 MeV/amu Ne-20) revealed the spatial uniformity of response of the Cerenkov counter to be better than 1% peak-to-peak. Light collection efficiency is independent of projectile energy and incidence angle to within at least 0.5%. Passive Lexan track recorders to measure range in the presence of the nuclear interaction background which results from stopping particles through 0.9 interaction lengths of matter were also tested. It was found that nuclear interactions produce an effective range straggling distribution only approximately 75% wider than that expected from range straggling alone. The combination of these tested techniques makes possible high mass resolution in the neighborhood of iron. Author

N76-22140*# California Univ., Berkeley. Dept. of Physics.
STATUS OF THE EVIDENCE FOR A MAGNETIC MONOPOLE
P. B. Price [1975] 54 p refs Sponsored by NASA
(NASA-CR-146807) Avail: NTIS HC $4.50 CSCL 03B

The experimental evidence supporting the detection of a moving magnetic monopole, using a balloon-borne array of track detectors, was presented. Although the results cannot be proved to have been produced by a monopole, they do not seem to have been produced by any nucleus. The very high, roughly constant ionization rate inferred from track etch rate measurements in a stack of Lexan detectors implies passage of a minimum-ionizing particle more highly charged than any known nucleus, yet the Cerenkov film detectors indicated a velocity less than about 0.68 times the speed of light and the size of the track in the nuclear emulsion indicated a velocity approximately equal to 0.5 times the speed of light. At this velocity the ionization rate of a highly electrically charged particle would have changed dramatically with pathlength unless its mass to charge ratio were far greater than that of a nucleus. Author

N76-22141*# California Univ., Berkeley. Dept. of Physics.
MONOPOLE TRACK CHARACTERISTICS IN PLASTIC DETECTORS
S. P. Ahlen [1975] 22 p refs
(Grant NGR-05-003-376)
(NASA-CR-146806) Avail: NTIS HC $3.50 CSCL 03B

Total and restricted energy loss rates were calculated for magnetic monopoles of charge g = 137 e in Lexan polycarbonate. Range-energy curves are also presented. The restricted energy loss model is used to estimate the appearance of a monopole track in plastic detectors. These results should be useful for the design and analysis of monopole experiments. Author

N76-22142# Kozponti Fizikai Kutato Intezet, Budapest (Hungary).
GALACTIC COSMIC RAY ANISOTROPY AT APPROXIMATELY 6.1013 e
T. Gombosi, J. Kota, A. J. Somogyi, A. Varga, B. Betev, L. Katsarski, S. Avlakov, and I. Khirov 1975 10 p refs Presented at the 14th Intern. Cosmic Ray Conf., West Germany, 15 Aug. 1975
(KFKI-75-46; Conf-750805-8) Avail: ERDA Depository Libraries HC $4.50

Arrival times of 1.14 x ten to the eighth power extensive air showers registered on the peak Musala (geographical latitude 42 deg N) were analyzed for sidereal variation. The solar and antisidereal waves remain below noise level while the first and second sidereal daily waves prove to be significant adding up to an anisotropy of 0.1 per cent. Intensity maximum is obtained when directions near the galactic plane are scanned. Some consequences of the result obtained are discussed.Author (NSA)

N76-22143# Kozponti Fizikai Kutato Intezet, Budapest (Hungary).
PROPAGATION OF 10 TO THE 11TH POWER TO 10 TO THE 14TH POWER eV PARTICLES IN THE GALAXY
T. Gombosi and J. Kota 1975 11 p refs Presented at the 14th Intern. Cosmic Ray Conf., Munich
(KFKI-75-48; Conf-750805-9) Avail: ERDA Depository Libraries HC $4.50

A semicompound diffusion model is suggested which combines the random separation of galactic field lines with compound diffusion. The diffusion's being one-dimensional is restricted to regions in which the field lines being initially gyroradius apart remain well-correlated. Assuming particle escape at the edges of the galactic disc the mean confinement time is given. Also discussed are the direction and magnitude of the anisotropy as well as its angular structure. Author (NSA)

N76-22144*# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
MEASUREMENT OF ENERGETIC PARTICLE RADIATION AT THE SYNCHRONOUS ALTITUDE ABOARD ATS-6 Interim Report
George A. Paulikas, J. Bernard Blake, and Sam S. Imamoto 30 Sep. 1975 32 p refs
(Contracts NASw-2762; F04701-75-C-0076)
(NASA-CR-146849; AD-A016530; TR-0076(6260-20)-7; SAMSO-TR-75-227) Avail: NTIS HC $4.00 CSCL 04/1

The Aerospace Corporation energetic electron-proton spectrometer operating on ATS-6 is described. This experiment detects energetic electrons in four channels between 140 keV and greater than 3.9 MeV, measures energetic protons in five energy channels between 2.3 and 80 MeV and energetic alpha particles in three channels between 9.4 and 94 MeV. After more than a year of operation in orbit, the experiment continues to return excellent data on the behavior of energetic magnetospheric electrons as well as information regarding the fluxes of solar protons and alpha particles. GRA

N76-22145# Emmanuel Coll., Boston, Mass.
PROTON FLUX DATA OBTAINED ON AIR FORCE SATELLITE 72-1 OVER THE PERIOD OCTOBER 1972 - FEBRUARY 1973
Ernest Holeman and Robert Filz Jun. 1975 42 p refs
(Contract F19628-73-C-0190; AF Proj. 8600)
(AD-A016569; SR-2; AFCRL-TR-75-0377) Avail: NTIS CSCL 04/1

This report provides a table of trapped proton directional and omnidirectional fluxes. The fluxes are obtained by summing all available data over the period October 1972 to February 1973. No corrections are made for instrumental effects or time variations. GRA

N76-22146# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
A COMPARISON OF VERTICAL COSMIC-RAY CUTOFF RIGIDITIES AS CALCULATED WITH DIFFERENT GEOMAGNETIC FIELD MODELS Interim Report
M. A. Shea and D. F. Smart 26 Nov. 1975 8 p refs

(AF Proj. 8600)
(AD-A018096; AFCRL-TR-75-0602) Avail: NTIS CSCL 04/1

The calculated values of cutoff rigidities determined by the trajectory-tracing technique are dependent upon which geomagnetic field model is used. In the past 20 years a number of geomagnetic field models have become available. In general each model is derived to fit the magnetic field data appropriate to a specific epoch with some of the more recent models containing time derivatives so that the models are applicable over a number of years. In the past the applicability of some models has been questioned inasmuch as small, but nevertheless significant, differences in vertical cutoff rigidities have been calculated with the different field models. The authors have used the time derivatives of the International Geomagnetic Reference Field model to calculate a selected set of vertical cutoff rigidities appropriate for Epoch 1955.0 and find that in general these values compare favorably with the results previously obtained using the Finch and Leaton 1955.0 field model. From these results and other epoch comparisons, it is found that vertical cutoff rigidities are essentially the same when calculated using comparable field models for the same epoch. GRA

N76-22147# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

AN ANALYSIS OF TRAJECTORY-DERIVED PENUMBRAL WIDTHS Interim Report

D. F. Smart and M. A. Shea 26 Nov. 1975 9 p refs
(AF Proj. 8600)
(AD-A018095; AFCRL-TR-75-0601) Avail: NTIS CSCL 04/1

A knowledge of the penumbra of the cosmic radiation is becoming increasingly important for a number of cosmic-ray measurements, particularly for those measurements employing geomagnetic effects as part of the sensor discrimination techniques. Although the penumbra has an extremely complex structure of allowed and forbidden bands, the authors have found that up to approximately 10 GV the penumbral width can be approximated by a simple power law relationship. GRA

N76-22148# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

A FIVE BY FIFTEEN DEGREE WORLD GRID OF CALCULATED COSMIC-RAY VERTICAL CUTOFF RIGIDITIES FOR 1965 AND 1975 Interim Report

M. A. Shea and D. F. Smart 26 Nov. 1975 9 p refs
(AF Proj. 8600)
(AD-A018093; AFCRL-TR-75-0599) Avail: NTIS CSCL 04/1

An updated five by fifteen degree world grid of trajectory-derived vertical cutoff rigidities for Epochs 1965 and 1975 has been calculated using the International Geomagnetic Reference Field with time derivatives applied for a 1975.0 Epoch. A comparison of these vertical cutoff rigidities with those calculated for Epoch 1955.0 shows that whereas minor changes in the cutoff rigidities (- or about equal 0.20 GV) occur in many areas of the world over this 20-year interval, major changes (= 0.60 GV) occur in the Central and Southern Atlantic Ocean area and over the Central and South American-land masses. While the changes in the Southern Hemisphere are primarily decreases in the vertical cutoff rigidities, there is an area in the Northern Hemisphere, principally in the Atlantic Ocean, where comparable increases in the vertical cutoff rigidities are calculated. GRA

N76-22149# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

VARIATIONS OF THE CALCULATED COSMIC-RAY EQUATOR OVER A 20 YEAR INTERVAL Interim Report

M. A. Shea and D. F. Smart 26 Nov. 1975 7 p refs
(AF Proj. 8600)
(AD-A018098; AFCRL-TR-75-0604) Avail: NTIS CSCL 04/1

The location of the cosmic-ray equator for two different epochs has been determined by calculating the vertical cutoff rigidities in the equatorial region using geomagnetic field models appropriate for 1965 and 1975. A comparison of these results with the cosmic-ray equator determined for Epoch 1955 shows that whereas no significant changes for this 20-year interval are found in the longitudes between 0 degrees and 270 degrees E, the theoretical equator has shifted slightly northward in the longitude range 280 degrees to 350 degrees E. GRA

99 GENERAL

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